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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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VOL. XLII., No. 19. FRIDAY, MAY 10, 1907.

The Cleveland & Marietta is a branch in Ohio of the Pennsylvania Lines West extending from Marietta on the Ohio river north 103 miles to a connection with a branch line of the Cleveland & Pittsburg, of which it is in reality an extension. As its mileage is all within the state of Ohio and it makes a separate annual report, which has just been issued, its passenger results for the year ended December 31, 1906, must reflect to a considerable extent the effect of the Ohio two-cent-fare law which went into operation in March of that year. More than this, these figures, though not conclusive for all the railroads in Ohio, should be typical of the effect of the reduction of passenger fares on the passenger earnings of short local lines in that state. During 1906 the number of passengers carried increased 13.5 per cent., and the number of passenger miles traveled, 12.4 per cent. over 1905. The passenger train mileage increased 1.3 per cent. Instead of an increase in gross earnings as a result of the 751,536 more passenger miles traveled, gross earnings from passenger traffic decreased 3 per cent. This was the result of a fall in the average passenger mile rate, as a result of the two-cent-fare law, of 2.9 mills or 12.2 per cent. The companies in the Pennsylvania system make a practice of reporting passenger expenses separately, these figures being obtained by assigning to the passenger service all expenses directly connected with its operation, and pro-rating expenses common to both freight and passenger service on the basis of car mileage. A slight reduction from the figure of the preceding year was made in the cost of operation but, even in spite of this, there was a loss per passenger per mile of 5.3 mills, about 50 per cent. more than in 1905. Translated to train-mile figures this means a loss of over 22 cents for each mile run by passenger trains during the year. The increased business resulting from the lower passenger fares did not make up for the loss in passenger earnings. Where population is dense the gain in business normally makes up for the loss in earnings due to reduced fares, but it is difficult to accomplish this result in any but thickly populated regions. Without a large amount of new business, there is a decrease in gross earnings with no corresponding decrease in operating expenses. On the contrary, there is likely to be an increase in operating expenses to care for what new business there is. The result of this one year's operation on the Cleveland & Marietta cannot be held to be conclusive, but if railroads in Ohio continue to find that the passenger business is being conducted at a loss, their natural action will be to reduce operating expenses by reducing the passenger service.

One large road, we hear, purposes to vote against the proposed universal penalty for wrongful diversion of freight cars, because the rule, as drawn, allows the arbitrator to be lenient with roads which, while innocent of wrongdoing, are suffering from an exceptional scarcity of cars. If a road has lent so many cars, and has received in return so few, that it has in use five per cent. less than it owns, it may be excused from paying penalty for using borrowed cars in local service. A road which has not suffered this five per cent. loss must settle in full for using anybody's cars in disregard of the owner's wishes. It is difficult to see the equity of this 95 per cent. provision, and it is easy to sympathize with those who are disposed to vote against it. But the rule, we think, ought to be adopted in spite of this apparent injustice in a detail. Even if the injustice be real, the rule is so important and so necessary that failure to adopt it would be a misfortune. This is a case where half a loaf is very much better than no bread at all. Even the attempt to cure the diversion disease, however poor the results, will be a useful educational process. Diversion is wrong, and always has been wrong, whether a penalty is assessed or not. If road *A* diverts and has to pay, while road *B* does the same and goes free, the fact is, indeed, irritating to *A*, but it will not be the first time that Justice has been a trifle inaccurate in aiming her arrows. The freight car problem is so big and unwieldly that only by the imposition of technical injustice on some roads can progress be made at all. The change from mileage to per diem has been accomplished only by the meek acceptance of unfair results in many places. In urging the adoption of a penalty rule we do not forget the committee's conclusion that penalties have thus far accomplished but little; neither do we despair of a pool. For ourselves, we must confess that the task of securing agreement on a pool seems mountainous, and the prospective task of managing one so that it would be worth its cost, still more difficult; but every well-considered effort in the direction of freight car economy by the present committee deserves the moral support of all railroads, because, as Commissioner Lane observes, such support is a duty of good citizenship. The penalty rule

is to be supported, therefore, because first, the Association has strongly recommended it and, second, because diversion of cars without their owners' consent is inherently and flagrantly wrong.

THE NEW YORK COMMISSION AND THE NEW YORK CENTRAL WRECK.

Concerning the derailment of the electric train on the Harlem division of the New York Central on February 16, the New York State Board of Railroad Commissioners has this week made public its report. Its length, between 5,000 and 6,000 words, and its having no facts or, indeed, opinions which have not heretofore been fully developed and published in these columns, prevents us from publishing it in full. It is quite within the bounds to say that this report has no value of any kind whatever, either in enabling the public to know more of the cause of railroad accidents, or as suggesting anything to a railroad officer. The significant parts are as follows: "No evidence was produced or discovered which would justify the board in charging the wreck either to obstacles on track, broken parts of equipment, or defects inherent in engines." The two remaining possible causes of the wreck considered by the board are "character of the track" and "high speed." As to "character of the track," the only positive statement in the report is as follows: "The testimony given tended to show that the track and roadbed were laid in accordance with the official standards of the New York Central Railroad both as to quality and super-elevation of the outer rail, and that that was in accordance with the standard recognized in American railroad construction; although the records of the company show that at one time the super-elevation at the point of derailment has been five inches. There is no evidence that the rough spot in the track, discovered the next morning, was experienced by any other engineer during the day and prior to the accident, although the morning engineer rode the same track during the day, but at a less rate of speed."

Concerning "high speed," the commissioners say that in compliance with their own suggestion the New York Central caused as nearly as possible a duplicate of the wrecked train to be made up and run over this section under what was believed to be the same application of power and brakes made by the motorman of the wrecked train. The commissioners report the result of this test as follows: "The train was running at 48.5 miles per hour at the point of the wreck."

The commission's finding, in view of its above quoted statements as to the quality of the track, of the testimony of the motorman and the man in the cab as to speed, of the commissioners' own experimental examination to indicate the probable speed, is a shocking example of the *non sequitur*. It is as follows:

> "The Board finds that the accident was caused by a condition of weak track, which was discovered and reported by the engineer of train 5X, which left the Grand Central Station on the morning of Feb. 16 at 9:03 a. m. Also that this bad spot became worse by reason of the pounding it received from numerous passing engines; holding, however, until subjected to the unusual and abnormal pressure exerted by the impact of the two powerful electric locomotives running at a very high rate of speed striking it in quick succession, shearing the spikes and causing the rail to spread. The accident, therefore, was the result of a track condition, plus speed; plus again the neglect to locate and remedy conditions that had been reported on the morning of the accident."

The recommendations are ten in number. Some are specific, some vague and others partaking rather of the nature of a sermon than of an official report. The recommendations are as follows, stars indicating omitted words of discussion or reaffirmation, which would have no interest to readers of the *Railroad Gazette:*

1. That the New York Central & Hudson River Railroad Company cause all tangent and curves on the main line tracks in the "electric zone" to be equipped with what is known as the "shoulder tie-plate," constructed with a shoulder on the outside of each rail with four spikes, two on either side of each rail, on each tie. * * *

2. That the company cause all curves in the "electric zone" to be maintained at a super-elevation not less than the present standard requirements.

3. The Board recommends that a careful, persistent and comprehensive observation of all conditions—track, roadbed, cars and engines—be made wherever electricity is being used, and that a record of such observations be kept in the office of the company, and that at stated periods, not less than four times a year, the result of these observations be filed with the Board of Railroad Commissioners. * * *

4. The Board recommends that there should be the same degree of intelligence in track maintenance as in track construction, and that it should somewhere appear, always affirmatively, in the records of the company and the responsibility located upon some particular officer, that the track and roadbed are fit for given trains of given weight and speed. The present system under examination is in accord, the Board believes, with the best standards of maintenance and direction for such maintenance given out from the office of the General Manager to the track walker. * * *

5. The Board recommends that some method should be devised whereby the line of responsibility between the construction and operating departments shall be kept clear and distinct. * * *

6. The Board recommends that it would be to the best interest of the public and the railroad company if the rules of the company required a consultation between the persons charged with maintenance of way of a particular division for instance, and the person charged with making up the train schedule, before such schedule were put in effect. * * *

7. The Board recommends that no one should be charged with the responsibility of construction of maintenance, where the non-performance of a duty may jeopardize human life, who is unable to express the result of his observations intelligently.

8. The Board recommends that rules should be so made in the carrying out of administrative duties as to make it impossible for the shifting of a responsibility from one person charged with it to another. * * *

9. That the company employ track walkers on each section in the "electric zone," at all hours of the day and night.

10. That each electric locomotive and each electric motor-car operated in the "electric zone" be equipped with fire extinguishers.

THE RATE OF RETURN ON RAILROAD SECURITIES.

As late as the years 1904 and 1905, and especially during the year 1901, the subject of the interest return to the conservative investor, as a question of the future, aroused much discussion and surmise. Under the influence of a prosperity not seriously marred by "high finance" on the one hand or corporation baiting on the other, the interest rate on high class investment had shown a distinct tendency downward. Municipal bonds, especially if locally non-taxable, had fallen to a 3.50 basis or even below. The best guaranteed railroad stocks were quoted regularly almost down to the same figure. Long bonds of high class dividend paying railroads ranged from 3.70 to 3.90; and some independent railroad stocks were forced up by the wave of speculation to a point which left even their own bond interest return behind. As a sequel there were a host of prophets who forecast a steadily declining interest return. Some of them even prefigured as a probability of a future decade or two an interest rate not exceeding 3 per cent. or even below that return. Vast accumulations of conservative capital, much of it hereditary, would, they said, bring about that result, if nothing else did.

Those prophets are not much in evidence now. They, and non-prophets as well, have during the last twelvemonth had opportunity for revisions of opinion and theories relating to the interest return. We have seen some of the financial laws that were supposed to be bed-rocked in experience seemingly reversed. "Prosperity" has been attended with immense shrinkage of the securities predicated upon it. We have had semi-panic without failures. Great railroad earnings have, on the face of things, forced down stocks; and increased dividends and new stock "melons" have done likewise. And, with it all, the interest return has soared upward. The financial seers of two years ago are 30 per cent. behind existent facts, let alone the future. But the fact of misguided forecast does not abate interest in the general problem of the future interest rate return. It rather intensifies it when, under the present anomalous conditions, we see over how large a field the question sweeps and how many and varied are its forces. No eye can look ahead far or very clearly. Yet some elements in a prognosis are discernible so far as they relate to railroads.

Change is the inflexible law of the financial world which, like the tides of the sea ebb and flow in shallows and depths and with countless waves on the surface. The fiscal market grows better or it grows worse, and its tendencies—what we may call its wavelengths—are apt to reach over considerable periods though, of course, broken by temporary ups and downs. The railroads are, of course, to a degree creatures of the market and have even been overmuch the victims of high finance. But certain of their credentials of intrinsic value are to be noted. One is their institutional character founded on three-quarters of a century of steady development. A second is their great cost and the impossibility of replacement. A third is their close relation to public necessity and convenience. A fourth is their intimate relationship to labor on an immense scale. A fifth is their character as a great fraction in the material and vested wealth of the country; and a sixth is their immunity from any destructive power of new invention—for even the revolutionary forces of electricity have simply adapted themselves to the old steam road. All the foregoing qualities of stability in values the railroads possess and—with the single exception of real estate—they are almost alone among the interests of the country in possessing them. If we may liken the railroad system to a ship it

is singularly well built and equipped to ride out and through financial storm. The system may encounter certain reverses. But if it does, it means that other great interests must encounter reverses that are worse. It is at least rational to infer, therefore, that whether railroads pay the investor a high or low return, the basis of return will be lower than the large majority of other investments simply because the security will be higher—even allowing for a certain insecurity resting on the quasi-public character of the railroad and resulting peril of legislative attack; and investors must put their money somewhere.

The railroad system of the country will, of course, have its revolving wheels within wheels in the mechanism of investment. We shall see periods of panic and semi-panic when both shares and bonds go down. We shall see speculative times when shares render a return lower than bonds; and we shall, very likely, see such a phenomenon as during the "long drag" from 1873 to 1878, when the bond interest return goes down while the stock return goes up—a psychological phase of investment due to the stock losses which focussed the investor's mind on security as contracted with speculative gain. There may also be times when the craze for some fresh form of investment temporarily depresses the railroad stock or bond. But for the reasons cited and in the long run the railroad investment must rank as a "preferred" one with relatively low interest return; and those who cry calamity and ruin based on popular and legislative assault forget what serious material hurt railroad calamity inflicts on communities and how quickly the sentiment in such communities reacts.

In all financial storms and rough weather the railroad must necessarily share in the general stress. When money rates are high, when business projects and demands outrun free capital, when securities of all kinds remain undigested the railroad security must fall in price too and its investment return be high; and, when the general fiscal conditions are reversed, the railroad investment return will be low. But through all such perturbations one may look confidently to the average railroad security for quicker recovery and more assured, if lower, return than any other group of investment in material plants.

But, turning from the relative to the more absolute question, will railroad returns on conservative investments revert to the low interest basis of the years that immediately preceded the present shrinkage of values? Under normal conditions of American finance and industry probably not in a generation, certainly not for many years. The proposition seems negatived by the material development of the country as great as it is persistent and stretching out, with its cry for new capital, in so many industrial directions. That broad and pervasive fact seems more potential on the future investment return than any spectres of harmful government regulation or socialism. On the other hand federal acquirement of the railroads would obviously reduce the interest return by enhancing the average security; and an experience like that of the middle seventies might repeat the era of lower return on railroad bonds. But both these contingencies we class as too abnormal and remote for sober consideration. Barring them, the investment return on the gilded or silver-gilt railroad investment, while almost sure to be lower than now, must wait long before returning to the old basis. Investors in long term bonds antecedent to the short term note period must console themselves now with the security rather than with the rate. They have, besides, the sentimental consolation of being victims of the unforseeable.

THE REHABILITATION OF THE BROOKLYN RAPID TRANSIT COMPANY.

Every public service corporation gets condemnation by its patrons, but in Brooklyn the intensity of bitter animosity toward the great transportation company which holds the borough in its grip of monopoly is of its own kind. It has no parallel. As an example of this public sentiment, the editor of one of the daily papers did not hesitate to say a few years ago that no paper in Brooklyn could financially afford to frankly commend the Brooklyn Rapid Transit Company for anything it had done or intended to do in that city. At every public meeting, in every political campaign the company had been the object of ridicule and abuse. This spirit of hostility is not roused in a community without just cause, and its abatement when the cause is removed, is even slower than its growth. Elsewhere in this issue we print the first of two articles which outline the reasons for this hostility and consider in detail the efforts of the company in recent years to regain favor by giving the city real rapid transit under conditions as difficult in many respects as can be found in any city in the world.

Brooklyn is essentially a city of homes, spread over a wide area. A large proportion of its citizens do business during the day on Manhattan Island, crossing the natural barrier, the East river, every night and morning. Let a single cog in the complicated machinery of transportation slip, a car be derailed, a power house break down, or an accident of any kind block the line, and immediately there is great inconvenience and much indignation. Let the cars stop moving for a day and business halts. It is no wonder then that the people of Brooklyn after having suffered for years from too frequent failures of a much overloaded and badly patched up transit system, became no longer satisfied with excuses and showed in every possible way their hatred of the corporation on which they must needs depend, but which could not or would not provide them with what, short of food and lodging, was their most important daily necessity.

From the time the surface lines were electrified in 1893 there began in the borough of Brooklyn an unprecedented growth of population. The only physical connection between Brooklyn and Manhattan up to 1905 was the Brooklyn Bridge. In 1897, when surface cars were first operated over the Brooklyn Bridge the yearly traffic was 50,000,000; in 1906, nine years later, the estimated traffic over the Brooklyn Bridge alone, not counting pedestrians, was 150,000,000 passengers, and, in addition, the Williamsburgh Bridge carried 45,000,000 and the ferries 100,000,000. The increase in travel between 1893 and 1902 far exceeded the increase in facilities for handling the traffic. The power houses were overloaded, the partly completed electrification of the elevated lines involved the care and operation of machinery which was relatively new and untried, the number of cars on both the surface and elevated lines was inadequate, and the equipment could not be spared from service long enough for proper inspection and repairs. Breakdowns and failures of all kinds were the natural result, and although not the company's fault, the disgraceful crowding in the rush hours at the Brooklyn Bridge was (as it still is) an insult to the decency of the citizens, who were obliged to fight their way on and off the cars every day. The company was blamed for this as well as for its own faults and failures. The property had been patched up from time to time, and the expenditures, even if well applied, which they were not, were wholly inadequate to provide the increased facilities needed. The service was undeniably bad.

In 1902, when Mr. Winter undertook the rehabilitation of the property, he faced a trying and complex situation. The citizens were hostile, the municipal government was antagonistic, and the property was a wreck. The first undertaking was to provide money for the extensive improvements which were absolutely and immediately necessary. This was done through a new refunding mortgage for $150,000,000, the proceeds to be used in retiring the securities of some of the constituent companies, and the remainder as required for improvements. The next work was to effect a complete reorganization and consolidation of the personnel and duties of the subordinate officers. Having the money and the men to carry out his plans, Mr. Winter began the far-reaching reconstruction whose progress thus far is outlined in these two articles.

Perhaps the hardest fight has been to free the company from the influences of political graft and to steer clear of the entanglements of city politics. The effort has been reasonably successful. For years the ward politicians and their favorite contractors, insurance agents and other henchmen reaped large profits from the company in return for immunity from the petty annoyances so easily applied. A volume might be written about the political intrigues which Mr. Winter has had to face in dealing with the bridge terminal problem, franchise grants, tax legislation and many other less important questions affecting the relations between the company and the city.

Depending on results rather than on promises and smooth words, Mr. Winter has been content for the most part to let the people of Brooklyn form their own conclusions as to whether or not the company was making a conscientious effort to remedy the evils so long suffered by the community and to provide a modern and efficient transit system. Shortly after he was made President a contract was made with the city for disposing of ashes in Brooklyn, and over $600,000 was invested in plant and equipment for removing the refuse. At that time the company was openly accused in some quarters of using unfair means in obtaining the contract. There have since been complaints that the collecting stations and incinerator plants constituted a public nuisance, and that the

ash cars caused delays to cars carrying passengers. The contract is soon to expire, and, more because it has aroused public hostility than because it has not been profitable, the company has notified the city that it will not again bid on the job. It will give up the business and write off on its books the investment of $692,000. There is some question as to when the contract expires. The company claims that it expires in 1907, but in spite of all the clamor about its having obtained the contract on unduly favorable terms, the company has been threatened with mandamus proceedings if it does not continue the collection of refuse until November, 1908.

Results of the improvement policy were not apparent at first, and the new administration came in for quite as much condemnation as the old, but the attitude of the public has been gradually changing. The innumerable civic organizations in Brooklyn no longer hold frequent meetings to denounce the company; only occasionally is an attempt made to make political capital out of it; the newspapers are ready and willing to give praise where praise is due. From a financial and operating standpoint the results of the improvements have been even more clearly marked. For the year ended June 30, 1902, the gross earnings were $12,510,622, net earnings $4,301,225, and net income after fixed charges $103,321. For the year ended June 30, 1906, gross earnings were $18,473,328, net earnings $8,031,951, and net income $2,742,952. With an increase of 48 per cent. in gross earnings, net earnings increased 86 per cent. and net income 2,450 per cent. The 1902 surplus, after deducting $84,428 for improvements, was only $18,893. In 1906, after deducting $1,652,113 for betterments and special appropriations, the surplus was $2,075,563. The operating ratio in 1902 was 65.5 per cent., and in 1906 had been reduced to 56.5 per cent.

The value of these improvements to the company is perhaps more strikingly illustrated in other ways, less important in the aggregate but more vital as really typifying the changes which have been wrought. Five years ago the insurance rate on the property of the Brooklyn Rapid Transit Company, including shops, stations, car barns, power houses and rolling stock, averaged $1.65 per $1,000. To-day it is $0.85, and this in spite of the fact that three years ago an arbitrary advance of 20 per cent. was made in the basis rate on all Brooklyn risks. The saving in yearly premiums, large as it is, is nowhere nearly so important as the reduction in the risk of destruction by fire of some important element of the transportation machine, which it indicates. Perhaps no better proof of the general toning up of the entire system can be had than the reduction of the amounts paid annually in settlement of damages for personal injuries. In the year ended June 30, 1901, 8.28 per cent. of the gross earnings was paid out in settlement of such claims. This percentage has been steadily lowered until for the year ended June 30, 1906, it was 3.71 per cent.; this notwithstanding the big increase in number of passengers carried. In 1906 the damages paid were over $300,000 less than in 1901, and less than in any year in the history of the Brooklyn Rapid Transit Company since it took over the lines which it now operates.

Proposed Advisory Board for Cape Colony.

In 1905 a resolution was adopted by the House of Assembly of Cape Colony calling on the government to consider the question of making some change in the management of railroads. A commission of seven members, with the Commissioner of Public Works, under whose authority are the railroads of the colony, as chairman, was appointed on February 4, 1907, and on March 1, after extended investigation, presented its report. With unimportant exceptions, the railroads of Cape Colony are owned and operated by the government, the government system including 2,865 miles. The roads are managed by the system usual in British colonial possessions, with a Commissioner, a government cabinet officer, at the head, and under him a General Manager, the active officer in control. The investigating commission in this instance reports that it is impressed with the necessity of removing as far as possible the railroad management from the influence of party politics without at the same time lessening the legitimate control which must be exercised by Parliament, as the representatives of the taxpayers. With this object in view, it submits certain recommendations, the first of which is that a railroad advisory board, not unlike the commission itself, be established, with the Commissioner of Public Works as chairman, four members of Parliament representing the legislature, two members appointed by the Governor from a list of names to be submitted by the various chambers of commerce of the colony, and two members representing the farming interest, a total of nine members. The functions proposed for this board are very broad, though they are all advisory. They include the general policy of railroad management in the colony and the relations of the Cape of Good Hope roads to other railroads in South Africa; fixing rates and fares for all classes of traffic; estimates of capital and other expenditures; the expenditure of any sum or placing of any contract of a value exceeding $25,000; all emergency expenditures; changes in the general organization, or those involving the abolition or creation of an office with salary of $2,000 or over; alterations in salaries, wages or hours of employment; changes in the train service, and measures of retrenchment. Besides these duties no proposal for new construction is to be presented to Parliament unless accompanied by a full report by the board, setting forth the capital expenditure to be incurred, estimates of the cost of working, the probable volume of traffic, revenue and effect on the traffic and earnings of existing lines. As an offset to these extensive fields of investigation it is expressly recommended that the board confine its attention mainly to large questions of policy, leaving the carrying out of all details of management to the executive officers of the railroad department. The interesting thing about this proposal is that it plans to give representation on the advisory board to the commercial and farming classes of the community who are most directly interested in the details of railroad management. In Prussia and other German states the local trade bodies have representation on a similar advisory board which must be consulted in regard to any proposed change in rates or service, and the system is said to work there with great success. There would seem to be no reason why such a body as that indicated by these proposals should not be successful in bringing about that co-operation between the railroads and the people which is to-day being found so necessary by our American railroad managers. The obvious drawback to this result in this case is that the four members of Parliament on the committee hold office only as long as they are members of Parliament, the same being true of the minister, who is chairman of the advisory board only during his term of office. This is contrary to the well established experience in this country that an able railroad commission is successful largely in proportion to its length of service. Railroad problems are at once so complicated and so vital that a body of men which is changing every few years fails of necessity to get the broad and experienced grasp of the subject which is above all else demanded in a body of this character. The success or failure of this advisory body in Cape Colony, if it shall be established, will be watched with interest, particularly as sooner or later some such formal recognition of the value of the advice of shippers and producers in railroad management is likely to be put in force in this country.

Dissatisfaction with the Italian railroads is becoming more serious than ever. It has received a further impetus from an incident by which the King of Italy himself was made to suffer. It is said that on a recent occasion, when His Majesty was about to make a journey from Rome, it was impossible to find a spare engineman on the spur of the moment, and the intended trip had to be abandoned. Whether this be true or not, there is no doubt that the general public, and especially the commercial community, has been suffering seriously. The mayors of three important cities, Genoa, Milan and Turin, recently met for the special purpose of protesting against the continued paralysis of the railroad service. The difficulty of making good the deficiencies in rolling stock, which existed when the roads were taken over by the state, have been recently emphasized, while one of the most authoritative deputies, formerly a Cabinet Minister, has just published a strong article on the subject. So important does he consider the industrial aspect of the matter that he calls upon the government, regardless of expense, to provide at once 1,000 more engines, 2,500 passenger cars, 400 baggage cars and 20,000 freight cars, and to appoint a Minister of Railroads, who will be directly responsible to Parliament, with a technical director under him. Even the employees seem to have derived little or no advantage from nationalization, which, as in Belgium, has benefited only the deputies and their friends. For, according to the well-known review, the *Nuova Antologia*, the rate of wages paid is miserable, and is in itself sufficient to explain the incompetence of the staff.

The Interstate Commerce Commission has advised California fruit shippers that it will take testimony in Los Angeles next Wednesday, May 15, on their complaint that the railroads are not furnishing a fair supply of cars for the shipment of oranges and lemons to the east. This complaint, which the fruit growers sent to Washington May 1 by telegraph, at an expense of $80, declares that the railroads are inflicting great hardship on the fruit trade by refusing to furnish cars until the fruit is actually packed and ready for shipment. According to the reports the action of the Commission on this complaint was unusually prompt and direct, which, no doubt, is the fact; but to a shipper with oranges rotting for lack of cars a response which takes fourteen days to get there must seem anything but prompt. Perhaps, however, the telegram promising to be there on the fifteenth is expected to do the business.

NEW PUBLICATIONS.

Allgemeine Eisenbahnkunde. Herausgegeben von L. Troske, Professor an der Techn. Hochschule, Hannover. Four parts—of these published Parts I. and II. 422 pp. Price, $3.00. Remainder in preparation. Royal octavo. Otto Spamer, Leipsig.

The important position occupied by railroads in modern industrial and economic life gives sufficient reason for this work. Its aim is to present in co-related form the various engineering activities that enter into building and equipping a railroad and the equally important subjects of management, administration and economics. While much of the subject matter has appeared in print, it was scattered through many books and pamphlets, or was to be found only in the files of the technical press. The author has done a signal service in gathering this information, systematizing it and presenting it as a whole. In this way he has not only furnished a text book for the student, but also a reference book for all who are interested in railroads. Written for an European, perhaps more especially for a German, audience, particular attention has been paid to European conditions, practice and requirements. While this is the case, the work is not less valuable on that account. Good practice on either side of the ocean is an incentive to good work, and it is knowing what has been done and what is being done that is of importance and makes for improvement. It is not the intention to convey the impression that American achievement and practice is neglected. Far from it, the many references to, and illustrations of what has been done here are abundant evidence to the contrary.

The subject is treated under four heads:

1. Location and Construction, pp. 112, 3 pl., 112 illust.
2. Equipment and Operation, pp. 310, 5 pl., 366 illust.
3. Cog Roads, Cable Roads and Street Railways (in preparation.)
4. Management and Railway Economics (in preparation).

Throughout footnotes refer the reader to original sources for fuller information. Only the most important formulas in connection with locomotive and train performance, as well as grade requirements are given, an elaborate discussion being beyond the scope of the work.

The growth and present condition of the railroad mileage and equipment of the different countries of the world is set forth in a series of tables. A condensation of some of these applying to conditions on January 1, 1905, is here given:

	Area, sq. miles.	Population.	Miles of railroad.	Miles of railroad per 100 sq. miles of area.	Miles of railroad per 10,000 of population.
Europe:					
Germany	208,710	56,367,000	34,505	16.5	6.1
Aus.-Hungary .	261,130	47,118,000	24,323	9.3	5.2
Great Britain..	121,200	41,450,000	22,540	18.8	5.4
France	207,050	38,962,000	28,425	13.7	7.3
Russia (Europe)	2,080,540	105,542,000	33,974	1.6	3.2
Bal. Europe ...	889,230	102,068,000	45,890	5.2	4.5
Total	3,767,860	391,507,000	189,657	5.0	4.8
N. & S. America:					
United States .	2,992,580	78,595,000	213,730	7.1	27.2
Br. Possessions.	3,427,220	5,553,000	20,250	0.6	36.5
Mexico	778,180	14,545,000	12,070	1.6	8.3
Central Am....	.....	.....	1,010	...	...
South America.	6,956,400	40,225,000	32,750	0.5	8.1
Total	14,154,380	138,918,000	279,810	1.9	20.0
Asia:					
Br. Possessions.	1,956,370	298,592,000	27,930	1.4	0.9
Rest of Asia...	.....	.....	20,010	...	...
Africa	.....	.....	16,190	...	...
Australia, New Zealand, etc....	3,082,010	4,942,000	16,800	0.5	34.0

Comparison of Equipment, Jan. 1, 1905.

	Total No. of locomotives.	Average equipment for 10 miles of road—Locomotives.	Passenger cars.	Fr't & baggage cars.
Germany	22,000	6.33	12.83	134.08
Austria-Hungary	9,140	3.75	7.66	84.15
Great Britain	22,180	9.80	22.14	333.18
France	12,130	4.27	11.19	112.37
Russia, in Europe.....	13,130	3.86	4.30	89.24
All Europe	93,500	4.93	.....	.....
United States	45,500	2.13	1.40	78.63
All other countries	29,000	1.98	.....	.....
Total	168,000	3.08	.....	.....

From this it appears that Europe, including Great Britain, with a somewhat smaller mileage than the United States, has in use two locomotives for every one in use in this country. In this tabulation only numbers of locomotives and cars are given, not capacities, and greater numbers do not necessarily mean greater capacity for transportation.

The part devoted to location and construction is as concise as a proper regard for the ground to be covered permits. The "development of the line" to overcome or to reduce grades is liberally illustrated by diagrams and topographical maps of the achievements of the engineer in different parts of the world. The various devices for lengthening the line—utilizing lateral valleys, loops, switchbacks, spirals, tunnels and combinations of these to suit particular case are all represented. In contrast to this careful presentation, the closely related subject of tunnels and bridges seems rather neglected, and a fuller treatment of them would have been welcome.

In Europe there is a persistent endeavor to utilize iron ties, and a large number are in use on different roads; but there, as here, the wooden tie is still regarded as the more satisfactory. To increase the life of the wooden tie, in addition to treating with preservatives, a number of methods are in use that have not found introduction in the United States. Experience goes to show that the wooden tie is destroyed by mechanical wear rather than by rot. To lengthen its life, it is now the rule on all new work of the Prussian State Railways to fasten the rail to the tie by screws instead of spikes. In line with this is also the procedure of screwing hardwood dowels soaked in tar oil into soft wood ties; the screws that hold down the rail screwing into central holes in the dowels. This method is followed to quite an extent in Germany and in Austria as well as in France, where it originated.

While thoroughness within the limits of the scheme of the work is evident throughout, the subject of the development of the locomotive has been treated with particular care, and in the section treating of signals, the system of interlocking signals is gone into with considerable detail.

In the development of the locomotive three important periods are recognized and serve as sub-heads:

1. Constructions to enable the locomotive to adapt itself readily to sharp curves (1851 to 1900).
2. Development of the two, three and four-cylinder compounds (1876 to 1900).
3. Development of the superheated steam locomotive (1902 to 1906).

The suggestion for an improvement is often made or its prototype tested years before the successful construction appears. The Fairlie locomotive of 1864 and the Gunther-Meyer of 1868 had their prototypes in trial engines built for the Lemering Railway in 1851. In 1848-50 the Great Western of England built a couple of two-cylinder compounds, but their performance was unsatisfactory. Various designs were subsequently proposed in England, France and the United States, but the first successful compound locomotives were built by Schneider & Co. at Creuzot in 1876. A few years later saw the introduction of the three and four-cylinder construction.

As early as 1863 Petiet took up superheating steam, and in 1870 the Burlington made experiments in this direction, but the results were unsatisfactory. The first successful superheater applied to locomotives was designed by Schmidt in 1898 and soon after introduced on the Prussian State Railways. This was followed in 1903 by the remarkably simple design of Pielock. The use of superheated steam has made rapid progress in Germany. Towards the end of 1906 more than 1,000 locomotives in operation and 600 in course of construction were using or being fitted out for its use.

Cars on both sides of the Atlantic have developed along lines acceptable to the public using them, and while in matters affecting the comfort and safety of travelers, they have many features in common, differences due to local conditions and tradition will always exist. The section on car construction and equipment gives excellent descriptions of the salient points.

The safeguarding of trains by automatic and interlocking signal devices is described at considerable length. The German practice is illustrated by diagrams and drawings. While probably not better than the best in use here, it is controlled by stricter legal requirements. In many ways this book will be a valuable addition to the library of the student and the engineer, and it is to be hoped that the two remaining parts will soon be published.

Combustion and Smokeless Furnaces. By Jos. W. Hays, New York: Hill Publishing Co. 101 pages, 6 in. by 9 in.; 15 illustrations. Price, $1.50.

It is a pity that the contents of this book cannot be driven home to the inner consciousness of all who have to do with smoke prevention and production, from the man at the shovel in the fireroom up through the several grades of responsibility, through the owner, the smoke inspector and the board of aldermen, guilty of passing so many and such absurd ordinances forbidding the production of smoke as though black soot were the one thing above all others that is to be prevented from passing out at the chimney's top. The book is not what would be called optimistic. It shows that, in the combustion of soft coal, for that is the only fuel considered, we have a problem of such magnitude that its complete solution upon a commercial basis is well-nigh impossible. Starting out with the definitions and theories of heat and combustion it discusses very thoroughly the principles that operate and the conditions that are necessary to fulfill in order to effect a perfect union of the combustible elements of the coal and the oxygen of the air; and while the conclusion reached is that smoke can be prevented such adverse criticisms are offered to all proposed plans of accomplishing this result that the reader is apt to be staggered by the prospect of being obliged to make an effort to succeed. All through the book the author draws a sharp line between what is theoretically and what is practically possible, and the difficulties of the latter are set forth with no unsparing hand. The first requirement of a good boiler and furnace, as seen by Prof. Thurston, is that it should "secure complete combustion of the fuel without permitting dilution of the products of combustion by excess of air." Then the utter futility of expecting to attain this acme of perfection in the fireroom is shown.

In the chapter on the Chimney Evil, the absurdity of the average run of smoke ordinances is clearly shown. The relative hygienic effects of soot and the products of smokeless chimneys are set forth very vigorously and one wonders, when these things are called to mind, how it is possible that city fathers can be so hoodwinked or so careless as to do what they do, until their average technical intelligence is brought to mind. The conclusions drawn from this chapter are that a chimney is a dangerous thing and that when it appears least offensive to the eye it may be pouring forth such volumes of poisonous gases as to make it a menace to the health of the whole community.

Then follows a discussion of the several methods that are used for promoting combustion and preventing smoke. Some receive a few words of commendation and all are criticised severely. Of all these the steam jet fares the worst. For this the author has not a single good word except that it is cheap to apply. It is shown to be wasteful and inefficient and is given such an arraignment that its condemnation must necessarily follow any intelligent reading of the counts that are made against it, and at the conclusion the "writer dismisses the steam jet with the feeling that a disagreeable duty has been honestly performed in the interests of good engineering."

In reviewing the various types of furnaces their good and bad points are set forth and the owner is urged to purchase according to his own requirements and not allow himself to be guided by the assurances of an insinuating salesman—above all, not to be led astray by a test. He declares that an evaporation test for furnace efficiency is a delusion and a snare, and that an analysis of flue gases should be the basis of the opinion to be formed.

It is evident that the author has no axe to grind nor any pet scheme to exploit for he puts things with unvarnished sincerity and an evident belief in his own truthfulness, and is necessarily pessimistic because he is in the same position that is occupied by others who have thought deeply on the subject; he sees no practical way to secure that complete combustion without an intermingling with the products that surplus of air which is more detrimental and uneconomical than incomplete combustion, and do it in a way that is practicable under ordinary working conditions. Thus the book becomes an earnest protest against those who, not knowing what they do, seek and ask for more than the present state of the art can supply.

Valve Gears for Steam Engines. By Cecil H. Peabody, Professor of Naval Architecture, Massachusetts Institute of Technology. New York: John Wiley & Sons. 142 pages, 6 in. by 9 in.; 33 folding plates. Cloth. $2.50.

In his preface the author states that "the book is intended to give engineering students instruction in the theory and practice of designing valve-gears for steam engines," and yet a certain rather extensive degree of familiarity with valve operation would be necessary in order to enable anyone to use the instructions intelligently and to advantage. Graphical methods are used throughout in the body of the book, and that is well, yet there are some places where a geometrical demonstration could have been introduced to advantage to have fixed the principle as well as the fact. For example, in speaking of the Zeuner diagram, which is used throughout, the author gives a geometrical demonstration of the accuracy of the line of valve displacement for any crank angle and then adds an algebraic expression for it, leaving the reader to work out the reason why, when a half dozen words would have made it quite clear.

When the voluminous mass of matter that has been written upon valves and their gears is considered, it is not to be expected that the whole subject can be treated exhaustively in a single volume of the size of the one under consideration. A general and brief review of the subject is therefore given, taking up the types of valve gears in most common use. Indications are given as to the main points to be considered in designing each of them, and warnings are sounded as to the pitfalls that are to be avoided, though the means to be followed in securing this avoidance are not always given with sufficient detail. But with this the reader is cautioned that "facility in design is to be obtained through experience only."

Especial attention is paid to the plain slide valve and the Stephenson link motion, to which 83 pages are devoted; but the Walschaert gear is dismissed with a scant two pages that, of course, merely skim over the subject and indicate in the most general way its construction, so that as far as the actual assistance rendered to the designer is concerned, the student will have to work out his own salvation by a personal analysis of the problem. The same brevity characterizes the treatment of the other radial gears, known as the Marshall, Hackworth and Joy. As an appendix, there is a mathematical analysis of the relative movements of the crank and connecting rod, the Stephenson motion and the Zeuner diagram which is well worked out, and serves as a demonstration and a guide to those engaged in important work where such an analysis will be valuable as a check. As the author states, "so much of the material used is the accumulation of common practice," that there is little that is new. The book may therefore be regarded as a rather valuable collection of guiding marks to indicate the general course to be pursued in the designing of a valve gear, and calling for previous training in order that these marks may be fully identified and used for the worth that they possess, but for the beginner and the novice it would probably prove a difficult morsel to absorb.

Universal Dictionary of Mechanical Drawing. By George H. Fellour. New York: The *Engineering News* Publishing Co. 60 pages; 8 in. by 11 in.; 45 illustrations; cloth. Price, $1.00.

As will be seen from the announcement paragraph, this book is not as large as its title would lead one to expect, but this does not prevent the contents from being up to those expectations. The author, who is now associate professor of machine design and mechanical drawing at the Carnegie Technical Schools, brings to his work the practical experience in large manufacturing establishments and so presents his subject with the brevity and clearness that drawings themselves should possess. It is not a book of instruction in mechanical drawing, but rather a series of brief essays on the way in which work should be executed in order to be most readily understood in the shop. He treats of mechanical drawing as a language, as truly as English is a language in which lines are analogous to letters; views to words; projected views to sentences; drawings to chapters, and sets of drawings to books. So this language is one "of lines, views, dimensions, signs and abreviations, notes and explanatory matter, all for the positive conveying of exact information." In setting forth the character of this language, he gives the various kinds of lines, letters and symbols that should be used, and places especial emphasis on the proper dimensioning of drawings. Those dimensions should be given that the shop will need and in the way that it will need them, and for this the draftsmen should be familiar with practice to an extent to enable him to determine the sequence in which the work will be done. If the book succeeds in driving this one principle home to the consciousness and practice of its readers it will have fulfilled a mission that should earn it the gratitude of every man who has to work from drawings that are too often faulty in this particular.

Then, too, he attacks "first angle," projection, and shows the absurdity of this method of representation, by which one is supposed to be looking through the piece to get at the face drawn, and it is to be hoped that what he says will have its proper effect in killing the practice. Finally he impresses upon his reader the fact that a mechanical drawing should be so self-contained that it needs no verbal explanation. The character of the material, the finish to be put upon it, the dimensions should all be so carefully inserted that it becomes "in effect an illustrated specification," and no term should be so abbreviated that it is possible for any misunderstanding to ensue.

As already stated, the book is not an instruction book, in the ordinary acceptation of the term, but one to be read and heeded by the man who is more or less skilled, and whose attention has either never been drawn to the points here set forth or who has become careless in the practice of them; and, as the great majority of draftsmen are embraced in one or the other of these two classes, it follows that there are few who would not be benefited by the perusal of this dictionary, though it is difficult to understand why it should be called by that name.

American Electric Railway Practice. By Albert B. Herrick, Consulting Engineer and Edward C. Boynton, General Manager of the Orange County Traction Company. 403 pages; 6 in. x 9 in.; cloth; fully illustrated. The McGraw Publishing Company, New York, 1907. Price, $3.00 net.

The work at hand is a very complete study of the elements entering into street railway construction and operation, including preliminary estimates, not only as to cost, but also as to traffic. The chapters include discussion of field engineering for interurban roads, track construction, location of power stations, design of a car house and repair shop and of rolling stock; maintenance of track, overhead structure and equipment; and a number of operating topics as well. In its general field and scope the book is comparable to Mr. Gotshall's Street Railway Economics, but brings practice up to date and deals with a rather more extended range of topics. In discussing competition with the steam roads, on page 4, a table is taken from the *Railroad Gazette* showing the decreases in passenger traffic in certain Ohio regions following the introduction of interurban cars.

The practical suggestions throughout the book are thoroughly good and the work is done in a studious and careful manner. The book should prove of material assistance to those who desire to put themselves abreast of the best current practice in street railway work, and it will be of great value to a large field of street railway officers, from the president of the company, to the power house foreman who desires to increase his usefulness and earning power.

The Earning Power of Railroads. 1907 Edition. Compiled and edited by Floyd W. Mundy, of Jas. H. Olyphant & Co., 20 Broad St., New York. 337 pages, 4¾ x 7 in. Cloth.

This convenient reference book of railroad mileage, earnings, surplus, capitalization, income account, operating expenses and other statistics, makes its annual appearance in the usual form, with current additions to the tabular matter. It is compiled with considerable care and with tolerable, though not always perfect, accuracy.

Its accuracy is sufficient, however, to serve what we understand to be the purpose of the book; a ready reference to suggest lines of inquiry that may be followed up, later, from original sources.

CONTRIBUTIONS

Superelevation.

Pittsburg, Pa., May 4, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the letter by Mr. John M. Fulton in your issue of May 3, regarding the effect of centrifugal force on a track where there is superelevation of the outer rail, it seems to me that Mr. Fulton has made several errors in arriving at his conclusion that superelevation does not affect the centrifugal force on the rails, unless it be greater than 12 in.

Mr. Fulton errs in comparing a body at rest on an inclined plane to one at motion on a track inclined at right angles to the direction of its motion. If the body on the inclined plane of Mr. Fulton's figure were in motion "at right angles to the paper," it would slide down the inclined plane, unless the force C pushing it up the plane were just equal to the component of the weight in the direction of the inclined plane; and if C exceeded the downhill force, the body would slide up the plane. A small force will move a very heavy weight that is supported on two revolving rollers, as per sketch, Fig. 1, and, unless these rollers are truly horizontal, the weight will slide down to the lowest point. This phenomenon does not in any way contradict the theory of friction. It is merely a matter of the resolution of forces.

It is common knowledge that if an attempt is made to move a body horizontally across an inclined plane, it will slide down, that is, it will take a diagonal direction across the plane. If a train were moving thus across a trackless inclined plane, it would slide down, unless a force were exerted to keep it up. This the centrifugal force supplies, and when the superelevation of the outer rail is correct for the speed, the centrifugal force just equals the component of the load in the direction of the incline. The resultant of the weight of the train and the centrifugal force then just bisects the distance between rails; that is, it is normal to the tie, and there is no centrifugal force on the rail tending to move it either way on the tie. The centrifugal force, however, is still present in a force tending to move the track, rails, ties and all bodily outward, because of the inclination of the resultant load on the track.

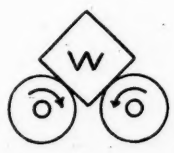


Fig. 1.

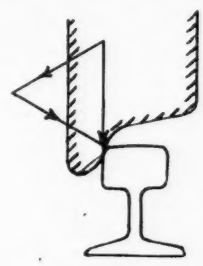


Fig. 2.

In the writer's opinion the simple centrifugal force is not the force that gives rise to the spreading of rails on curves, and the spikes are not the most effective agent in preventing that spreading. The tendency of the outer forward wheel to climb the outer rail, due to the impulse of the locomotive to go in a straight line, is what causes the heavy force on the outer rail. If the axles were set radially to any given curve, and the outer wheels were of larger diameter than the inner ones, so that there would be no slipping, and if the outer rail were elevated the proper amount for a given speed, there would be practically no force on the rails tending to move them radially. The spikes would have no more work than on a tangent, and friction of the rail on the tie would not be called into play to prevent lateral movement. Such conditions, of course, are not attainable on a railroad, but because they are conceivable, there is a suggestion that the centrifugal force, as ordinarily understood, has little to do with spreading of rails in such accidents as the one that occurred a short time ago in New York on the New York Central.

It is not the mere inertia of a train that tends to make it go in a straight line on a curve. On a trackless plane, with larger wheels on one side than the other, it would go in a curve in spite of the inertia tending to make it go straight, and it would exert a strong force against any kind of guide that would force it to go in a straight line. The fact that in a locomotive the inner wheels have the same diameter as the outer ones makes these wheels tend to roll off the side of the inner rail and to force the locomotive against the outer rail. Further than this, the tread being sloped will give a tendency for the inner wheel to seek a section of smaller diameter to fit the shorter length of inner rail. It is these tendencies and forces that cause the wearing on the inner side of outer rail on a curve. The most serious aspect of this climbing tendency of the outer wheel is the fact that there results a wedging force on the inner side of the head of the outer rail, as indicated in Fig. 2. The resultant force on the rail will bear little relation to the centrifugal force, as it may be a large fraction of the wheel load.

It is doubtless this wedging action of the wheels that is the cause of spreading of the rails. It is scarcely practicable to meet such a force by the use of spikes, and it is scarcely probable that the spikes do actually resist it. There is, however, a means by which this force can more effectually be resisted, namely, in the continuity of rails in curves and in substantial splices that allow no motion longitudinally. The force is thus reduced to one of tension on the rail.

EDWARD GODFREY.

The Profitable Weight and Speed of Freight Trains.

Baltimore, Md., May 4, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

With regard to Mr. B. A. Worthington's letter of the 13th ult. appearing in your issue of the 26th ult., it seems impossible to persuade him to fix his mind on anything save the conditions that have governed in all directions the operation of the big slow moving freight train. For example, he says "let us double the traffic and have four freight trains each way per day" instead of the original two. That is to say, he proposes to keep the freight trains of the same consist although the *raison d'être* of the doubling is a reduced consist.

It cannot, of course, be disputed that on an equal number of trains in either direction the number of meetings will be the square of the number of trains one way, so that two trains each way means four meetings, and four trains each way means 16 meetings, and Mr. Worthington says that it would be folly to assume that the gain in the average time for the four trains could all be put into moving time because of the large increase in number of meetings.

I subjoin two time-tables to cover the movement of two trains each way and four trains each way which demonstrate that this folly is nothing more than the quality of an obsessed imagination. The postulates for these time-tables are as follows: Track 50 miles long, stations five miles apart and no station with capacity for more than two trains at one time. The motion speed of the eight trains to be 20 miles per hour and of the four trains 13.5 miles per hour, the latter being half way between the 12 and 15 miles an hour motion speed mentioned by Mr. Worthington. Trains to start 10 minutes apart and even numbered trains to have right to the road.

Stations 5 miles apart.			Trains				Trains,			
			No. 2.	No. 4.	No. 6.	No. 8.	No. 1.	No. 3.	No. 5.	No. 7.
Sta.	A,	Lv.	1:00	1:10	1:20	1:30	Ar. 4:00	4:30	4:45	5:30
"	B,	"	1:15	1:25	1:35	1:45	" 3:45	4:15	4:30	5:15
"	C,	"	1:30	1:40	1:50	2:00	" 3:30	4:00	4:15	5:00
"	D,	"	1:45	1:55	2:05	2:15	" 3:15	3:45	4:00	4:45
"	E,	"	2:00	2:10	2:20	2:30	" 3:00	3:30	3:45	4:30
"	F,	"	2:15 x 1	2:25 x 1	2:35 x 1	2:45 x 1	" 2:00	3:15	3:30	4:15
"	G,	"	2:30 x 3	2:40 x 3	2:50 x 3	3:00 x 3	" 1:45	1:55	3:15	4:00
"	H,	"	2:45 x 5	2:55 x 5	3:05 x 5	3:15 x 5	" 1:30	1:40	1:50	3:45
"	I,	"	3:00 x 7	3:10 x 7	3:20 x 7	3:30 x 7	" 1:15	1:25	1:35	1:45
"	J,	"	3:15	3:25	3:35	3:45	" 1:00	1:10	1:20	1:30
"	K,	Ar.	3:30	3:40	3:50	4:00	Lv. 12:45	12:55	1:05	1:15

Stations 5 miles apart.			Train			Train	
			No. 2.	No. 4.		No. 1.	No. 3.
Station	A,	..... Depart	1:00	1:10	Arrive	4:50	5:34
"	B,	..... "	1:22	1:32	"	4:28	5:12
"	C,	..... "	1:44	1:54	"	4:06	4:50
"	D,	..... "	2:06	2:16	"	3:44	4:28
"	E,	..... "	2:28	2:38	"	3:22	4:06
"	F,	..... "	2:50 x 1	3:00 x 1	"	2:35	3:44
"	G,	..... "	3:12 x 3	3:22 x 3	"	2:13	2:23
"	H,	..... "	3:34	3:44	"	1:51	2:01
"	I,	..... "	3:56	4:06	"	1:29	1:39
"	J,	..... "	4:18	4:28	"	1:07	1:17
"	K,	..... Arrive	4:40	4:50	Depart	12:45	12:55

Anyone who cares to work over these time-tables will see that the smaller of them is unfavorable to my side of the argument inasmuch as the actual time required to accomplish five miles at 13.5 miles per hour is 22.2 minutes, while I have used 22 minutes only; but even so it will be observed that the complete movement of the eight trains can be accomplished in four minutes less time than that of the four trains. In addition to this there is an accumulation of 10 hours and 15 minutes of engine hours up to 5.30 o'clock for the eight train movement, during which the engines which have completed their runs can be undergoing repairs or accumulating more net revenue or be placed in reserve under white-lead, according to the demands of the traffic. Similar accumulation for the smaller movement amounts to no more than 2 hours and 22 minutes.

Mr. Worthington will no doubt respond to this that the larger movement has required the use of double the number of engines. So be it; but against the capital cost of the larger number of engines it is perfectly fair to set:

First.—The increased earning power of the cars for the eight train movement circulates 224 as against 160 cars under the four train movement, and does it, too, in considerably shorter average time per car. (This is recommended to the particular considera-

tion of the Joveian-browed deities who preside in the American Railway Association over the efficiency of cars.)

Second.—The capital cost of the extensive additions to track now being urged by the advocates of the big slow moving train.

Third.—The operating advantage of having a larger number of highly trained men in the railroad services.

With regard to the amount of net revenue over and above the expense included in my original table that can be accumulated by the two movements, I submit the following calculations:

Eight Train Movement.

8 trains at 28 cars = 224 cars.	
224 cars at 50 miles = 11,200 car miles.	
11,200 car miles at 9 cts. per car mile	$1,008.00
400 train miles at 55 cts.	220.00
Net revenue	$788.00

Four Train Movement.

4 trains at 40 cars = 160 cars.	
160 cars at 50 miles = 8,000 car miles.	
8,000 car miles at 10 cents per car mile	$800.00
200 train miles at 75 cts.	150.00
Net revenue	$650.00

Even should it be said that the 55 cents cost per train-mile for the larger movement is too low this cost can be increased to 65 cents and still there will be more net revenue remaining to the larger movement by $98. Even 8 cents a car-mile with 55 cents train-mile cost nets $26 more to the larger movement.

A further argument that will be urged against the larger movement will no doubt be the increased wear and tear of track, but I should think in view of present conditions that such an argument would prove rather a boomerang to the advocates of concentrated weight in cars and engines. It is understood present rail and track troubles are to be overcome by revising the rail section, putting less into the head of the rail and more into the web. When this has been accomplished there will be no doubt the same urgency for rail improvement on account of reduced admissibility of wear of the head; only then the agitation will be over another aspect of the problem. Amid these constant differences of opinion between engineers, may it not rightfully occur to those who have a little tenderness for the proprietors of the railroads to suggest the desirability of compromise so as to give the rail a fair run for its money?

Mr. Worthington reads too literally my remark about the exact science employed in the loading of engines of late years. His reference to empirical formulae is right enough; nevertheless the empiricism in his suggestion that it is folly to assume that a fourfold increase in train crossings can be taken up in faster movement seems to need the application of a little exact science in the shape of figures of a time-table. Although the delay time in the larger movement, as per foregoing time-tables, is 18.2 per cent. of the total time the trains are on the road as compared with 8.7 per cent. in the smaller movement, yet the larger movement is completed in four minutes less time. This appears to be a materialistic illustration of "death swallowed up in victory"; the faster movement has swallowed the delays and the dose agrees with it very well.

It is perfectly evident that I shall not succeed in convincing Mr. Worthington that his view of the construction of rates and freight tariffs is fundamentally wrong. I will therefore content myself with reaffirming that a revenue of $1.28 per ton for a haul of 250 miles is not enough for any class of traffic he likes to name in comparison with the present standard of compensation for transportation service, low as that is, and that it is an astonishingly and almost unbelievable low compensation for a railroad on which 70 per cent. of the business was high class traffic.

M. B. WILD.

Continuous Rails for Uniform Track Structure.

Buffalo, N. Y., May 6, 1907.

To the Editor of the Railroad Gazette:

The contribution in your issue of May 3 concerning your editorial in the issue of April 12th on the subject of continuous rails for uniform track structure seems to suggest further comment on this important subject. The statement that "the primary cause of low joints is the impact of passing wheels on the rail ends" does not seem to get to the bottom of the facts. To be sure, this impact is what causes the damage, but to go one step further back: Is not this impact a *result* rather than a *cause?* Your editorial points out this fact in stating that destructive battering is the result of a lack of stiffness in the rail structure. When one simply glances over the four or five pages of cuts which appear in this same issue of May 3d in connection with another article, and which show track deformations, it does not take long to decide that the principle cause of this impact is excessive deflection, and that the problem is not simply a question of the "proper maintenance of track" without any reference to the design or stiffness of the joint. One can see clearly from a glance at these cuts how greatly the impact on the rail ends would be reduced if the joints were as stiff as the rail and did not allow the rail ends to go down to a position where they receive destructive shock from passing wheels. That this deflection and consequent impact at the joints has been largely eliminated by the use of a depending flange is now being practically demonstrated every day by several designs of thoroughly practical joints.

The suggestion might be advanced for the further consideration of such roads as have condemned the depending flange, that they are neglecting a right principle on account of a wrong application; that they may have experimented with a light or poorly designed deep joint involving such undesirable features as would counteract the benefit that should be derived from a suitable depending flange bar, and that they are condemning the depending flange generally on account of a limited experiment with what they properly have determined to be a poor type of depending flange joint. The adding of a depending flange to a bar does not in itself eliminate other undesirable features such as wide spiking flanges, broad base supports, etc. On this account it is very difficult to place the blame for the failure of a joint where it belongs, and some roads are not getting the benefit of the deep-bar joint on account of not carrying their experiments to a complete conclusion. As mentioned in your editorial, the common angle bar has many desirable features. Even with its one-third stiffness it may prove better than some types of depending joints, which, on account of other features, may allow as much deflection as the angle bars; such conditions as this has made the progress of the depending flange slow.

The collecting of ice under rail joints has often been noted, especially on northern roads; but the cause is usually attributed to weak or loose joints which allow the roadbed to pound full of holes and accumulate all the water from an undrained roadbed. There is a depending type of joint now made by one of the steel companies similar to the one outlined in your editorial, which only extends 2¼ in. below the rail base, and it can hardly be conceived how such a flange as this could be blamed for the ice that might collect under the joints in badly drained locations, and it seems reasonable to think that such a short stiff inwardly depending flange aids in breaking up the ice instead of being affected by it.

The "bolt connection" of a joint is mentioned as being the "limiting factor of strength rather than the section of the bar at the rail ends." This is correct, and one will be surprised to find how much less of a factor the bolt connection is with properly designed bars as stiff as the rail than with bars requiring the bolts to do nearly all the work. A proof that this bolt connection can be brought up high enough to give a joint as stiff as the rail is only a question of observation of present bars in track, or of actual demonstration on a testing machine.

In regard to the question of hard angle bars, your editorial outlines what has proven to be the experience of most roads. The increase in stiffness by this means is so slight that there hardly seems to be any defence for the practice on this score; and as for diminishing excessive wear on the bars, the best method for preventing this would seem to be to decrease the deflection and battering and consequent loose bolts by the use of the proper kind of a depending flange bar. Many roads do not have sufficient heavy traffic to show up very quickly the difference between a good depending flange joint and a common angle bar joint made of hard steel. The saving and necessity of the deep bar naturally, of course, increases with the traffic, and it has, therefore, come into general use on such roads as would find it impossible to maintain the old fish-plate joint. This is no argument that the deep joint should be limited to main line tracks carrying heavy and frequent high-speed trains, since it should show the same economies to a less degree under lighter traffic as it does under the heavier service. The excessive cost of properly maintaining the fish-plate joint is exactly what has caused the development and acceptance of the depending flange, and it seems rather to be a question of finding a joint that will require the least care, rather than one that can be entirely neglected. The depending flange is a waste of metal unless held up to the work, and it cannot be expected to eliminate the tightening of bolts, which is only a very small part of the cost of track maintenance. Loose bolts in any joint simply means destruction, and the depending flange seems to be the best means yet found for preventing the shocks and vibrations which cause loose bolts and loss of efficiency in a rail joint.

S. GARVER.

Inside Valve Clearances.

Philadelphia, May 6, 1907.

To the Editor of the Railroad Gazette:

Your editorial on page 603 of May 3, 1907, was read with much pleasure (Locomotive Performance Data Developed at Purdue) and deserves consideration by all interested in the economical performance of the locomotive. What I wish to call your attention to is the part that refers to inside clearance in the valve. The editorial states that it "never existed except where some careless workman planed out the D of valve too much." This is a mistake, as the writer knows of it being used on the Delaware, Lackawanna & Western in the 50s; also it was the standard practice of Wilson Eddy, Master Mechanic of the Boston & Albany, for many years. The engines in freight service had a 5-in. travel of valve with ¾ in.

outside lap at each end and $^5/_{16}$ in. inside clearance, i.e., the cavity of valve was $^5/_{16}$ in. wider than the exhaust port and the two bridges combined. My object of calling your attention to this matter is that editorials of this nature are what history is made of, and anything not correct is not good history.

HENRY F. COLVIN,
Secretary Rue Mfg. Company.

The 16th Street Track Elevation of the Burlington at Chicago.

Probably the busiest stretch of track on the Burlington is that between its Western avenue yard and Canal street, parallel and immediately adjacent to 16th street, Chicago. Not only does it carry all of the through passenger and suburban traffic of the Chicago terminal division, but all of the freight business passing through its largest city freight houses and its boat-lines' interchange on the river at Canal and 16th streets. The city ordinance providing for elevation of this section required it to start from grade at Canal street and return to grade again at Western avenue, a total distance of 2.4 miles. Prior to beginning the work there were four main-line tracks. There were also, in addition to the Western avenue yard, team tracks amounting to about 1¼ miles of trackage between Halsted and Morgan streets in conjunction with the two freight houses between Canal and Union streets, and a storage yard of some half a dozen tracks aggregating about 1½ miles, from Morgan street to Blue Island avenue. The work included the addition of two main-line tracks, making six in all, to relieve the pressure, which had grown too great for four lines, and the elevation of all tracks and yards within the limits covered by the ordinance.

As will be seen by the accompanying plate and profile of the work (Fig. 1), a part of same was done in 1906. This was about one-third of the total, starting at Wood street on the west, with run-off reaching west of Robey street, and extending east of Laflin street with run-off to Center avenue. This work was practically completed with the exception of the subway bridges, the tracks being carried over the openings on temporary timber bridges. As already mentioned, two additional main line tracks were laid. The width of right-of-way over the district affected varies from 140 ft. to 200 ft. so that no increase in same was necessary. It was endeavored during the progress of the work to keep at least four tracks open to traffic, although occasionally this was temporarily reduced to three. Filling was begun with the south track. A trestle was built (see Fig. 2) from which the bank was brought up to the new grade. The timber work was then removed and the track, which was one of the two new ones, laid on top of the bank. This was then used as a working track to raise the one next to it, all of the four original main-line tracks being raised in turn in like manner. When the bank was ready the track would be taken to pieces and relaid on the new grade. Each track was thus shifted south to a new position an amount about equal to the distance between track centers. This left space on the north for the other new main track already referred to, making six in all. The filling material was brought from the Burlington's gravel pit at Montgomery, about 42 miles west of Chicago. It was moved in side-

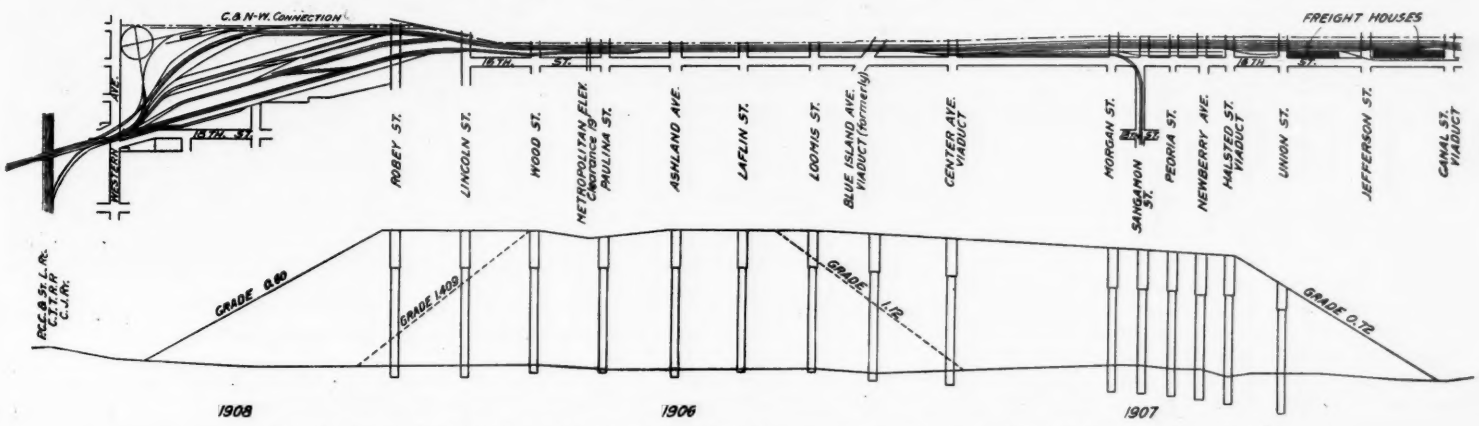


Fig. 1—Plan and Profile of 16th Street Track Elevation; Chicago, Burlington & Quincy.

Fig. 2—Looking West from Paulina Street; Ready to Fill.

dump cars, about 35 to the train, and deposited with a Lidgerwood unloader. As the material was deposited it would be spread with a ballast spreader which would follow each train load. The fill was thus built out to the requisite width, and a final trip of the spreader, taking only a slight cut, left it ready for the track, as in Fig. 3.

Filling for the 1907 work, which is all of that east of the 1906 portion, has not yet been begun, except to raise the grade of the present east run-off to permit the Blue Island avenue subway to be built. As the plan indicates, there was formerly a viaduct to carry this street over the tracks. There are also viaducts at Center avenue and at Halsted street. Blue Island avenue has been closed since the removal of its viaduct in 1906, traffic being diverted over the viaduct at Center avenue. The Blue Island avenue subway is now being completed in preparation for the removal of the Center avenue viaduct.

Adjacent to the Burlington's right-of-way, in the north, is the Chicago & North-Western's double-track line between its Wood street and 16th street freight houses. This line also is being raised under the same ordinance as that of the Burlington, and the two roads are working in conjunction. The right-of-way of the North-Western is very narrow and it will make use of the adjacent track of the Burlington to maintain traffic while raising its tracks; the

Fig. 3—Fill Leveled by Ballast Spreader Ready for Track; North-Western Fill on Left.

Burlington in turn will enjoy a like privilege from its neighbor when necessary. The railroads are required to remove the street viaducts already mentioned, the expense for which is shared by the two on an agreed basis. The crossing of the Metropolitan West Side Elevated Railway just west of Paulina street is a 200-ft. through truss span. This had to be raised 19 ft. to maintain the original clearance, the work being done by the owning company.

Mention has been made of team and storage tracks at the eastern end of the work. With the new arrangement of the tracks, there will be team tracks on the elevation all the way from Union to Laflin streets, with entrance respectively at Union, Morgan, Allport (just east of Blue Island avenue) and Ashland avenue. The roadways for all tracks will be brick paved.

The most interesting single feature of the work is the subway bridges, which embody several features novel to such structures in the Chicago track elevation work. As originally designed these bridges were to be reinforced concrete floor slabs resting on steel cross girders, the steel column supports of the latter to have concrete floating foundations. But the soil on which these foundations were to rest, the blue clay which underlies Chicago, was of a particularly soft, yielding character in this vicinity and it was decided that such a foundation, even with the greatest spread possible, would not sustain the loading. Piling was then considered, but there was doubt about this also, even with the longest piles available, and it was finally determined to carry the foundations to bed rock or hard pan. The subway cross-section (Fig. 5) shows these circular concrete piers, 3 ft. 8 in. in diameter. Meanwhile, the steel work for the bridges for the 1906 work had been ordered, and in due course was erected. However, the character of the foundations finally adopted, eliminating all possibility of settlement, made possible the substitution of reinforced concrete cross girders and columns for the steel work, and designs were accordingly prepared for all-concrete structures for the 1907 work. Details are shown in Fig. 6.

The column reinforcing, it will be observed, is four 3½ in. x 3½ in. x ½ in. angles, 11 ft. long, held to position by 6 in. x ½ in. x 17¾ in. plates riveted thereto at intervals as shown in the detail, the whole being wrapped around with No. 11 high carbon steel wire

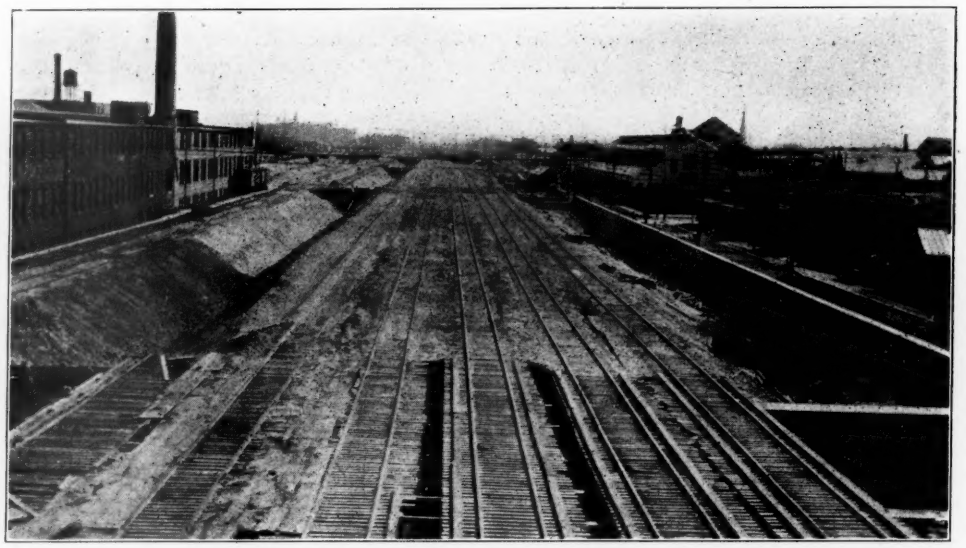


Fig. 4—Looking East from Metropolitan West Side Elevated Bridge; Five Tracks Raised; North-Western Tracks on Left.

from the top of the foundation to the bottom of the cross girder fillet. The angles themselves extend well into foundation and girder. The girder reinforcement is ½ in. and 1 in. corrugated steel bars, disposed as shown by the drawing. The columns are 2 ft. square in section and the girders are 4 ft. deep and 2 ft. 6 in. wide.

The large floor slabs—the street slabs—are 24 ft. 2½ in. long, 6 ft. 11¾ in. wide for the standard slab, and 2 ft. 9 in. thick for

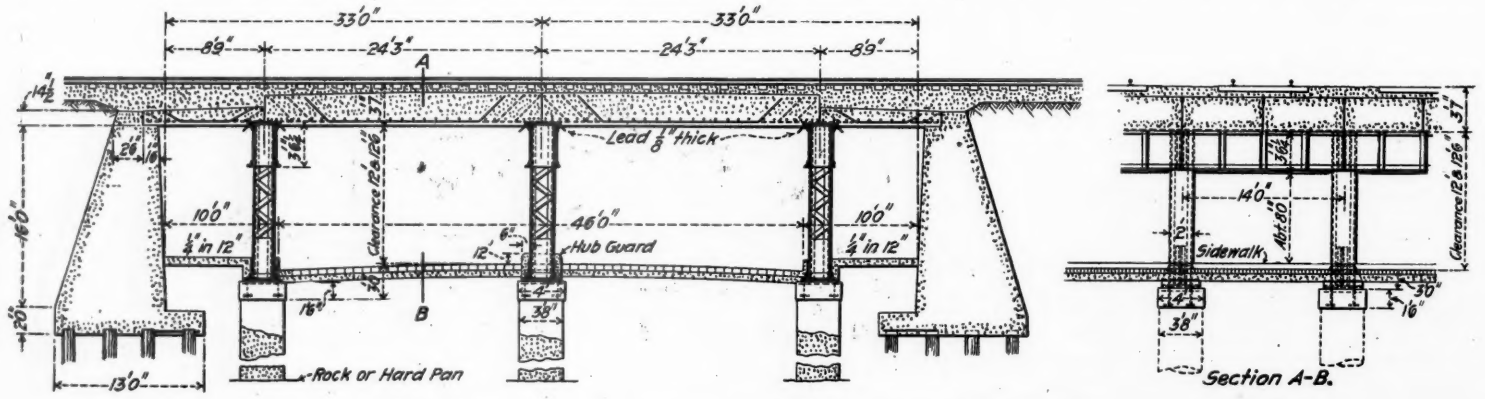


Fig. 5—Canal St. to Western Ave.; Typical Sections at Subway.

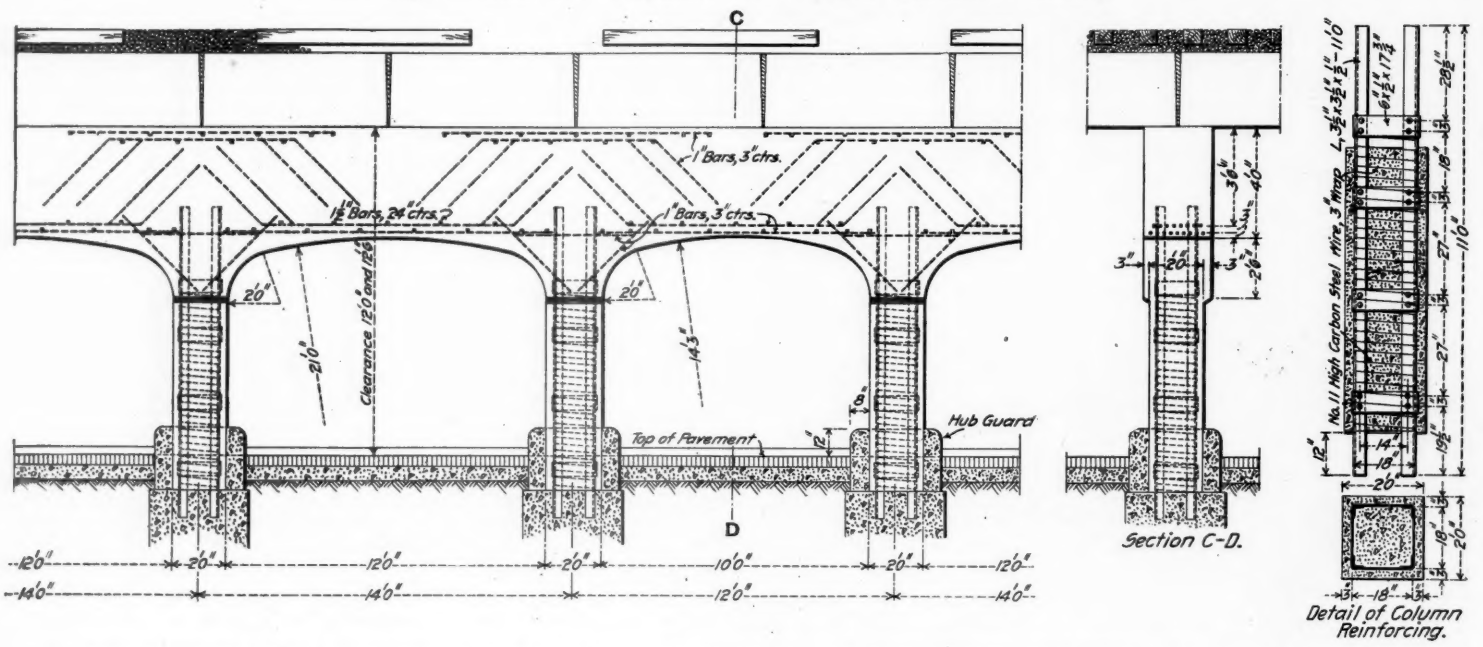


Fig. 6—Typical Section Showing Reinforced Concrete Columns and Cross Girders and Detail of Column Reinforcing.

half of their length, reducing to 2 ft. 6 in. at the sidewalk end to give a 3 in. drainage drop. The standard sidewalk slabs are 10 ft. 8½ in. long, 6 ft. 11¾ in. wide, 1 ft. 5½ in. thick at the street end and 3 in. less at the abutment end. The bridges are designed for Cooper's E-50 loading with a 100 per cent. impact allowance, the whole being considered as acting on a width of 10 ft. The slab reinforcement is 1.29 per cent. of corrugated steel bars, ½ in. and 1 in. sizes, their arrangement being shown in the slab details (Fig. 7). The slabs were made in 6 ft. widths also, to provide for varying track centers, there being 12 ft., 13 ft. and 14 ft. spacings. The slabs for the 1906 bridges were all made last fall. They are a 1:4 gravel mixture and the large street slabs weigh about 34 tons. The derrick car has a 40-ft. boom, and is used for loading the slabs onto cars at point of manufacture as well as for placing them on the bridges. The slabs are brought to the work only as they are needed and the derrick car therefore does the loading at night in order that it may be available during the day for setting.

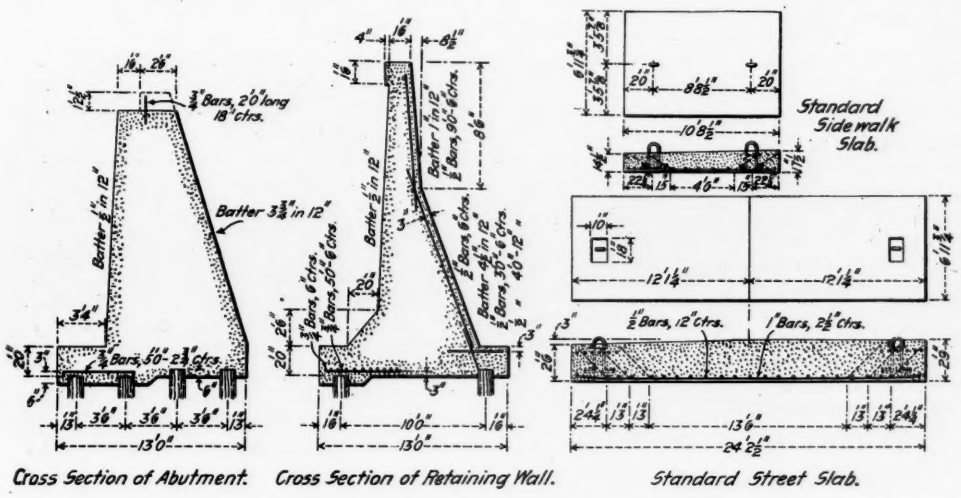


Fig. 7—Typical Sections, Burlington Track Elevation.

For the steel cross girders (Fig. 5) the ends of all slabs resting thereon were shouldered out 1 in. deep and 15 in. back to fit over same. Sheet lead ⅛ in. thick was laid over the top of the girder to protect the steel and a layer of mortar spread over all contact surfaces just before placing the slabs. For the concrete cross girders the slab bottoms will be plain. All slabs have their edges painted with a waterproofing compound before setting. To make the inter-slab joints water tight they are first calked with oakum at the bottom and the waterproofing compound run in on this. The remainder of the opening is then filled with grout. For the sides of the bridges a special parapet slab is made, narrower than the regular slabs and having a parapet 4 ft. ¼ in. high from the bottom of the slab.

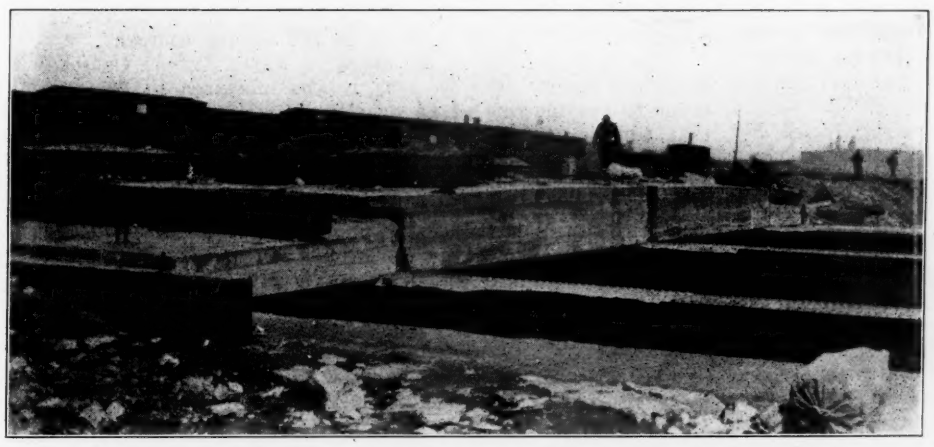


Fig. 9—Reinforced Concrete Slabs in Place on Subway Bridge.

Regarding costs, the concrete pier foundations to bed rock were estimated to be no more expensive than pile foundations. On the basis of all-steel bridges for the work, the saving by the use of the concrete superstructures is estimated at about $250,000. This allows for the steel work in the 1906 work.

Cross sections are shown of the retaining walls and abutments (Fig. 7). They are gravel concrete, a 1:4 ½ mixture, and are reinforced with corrugated bars as shown. They rest on piling.

Referring again to Fig. 1, it will be observed that the work west of the 1906 section is marked for 1908. This includes Western avenue yard. This is an exchange yard for interchanging traffic with foreign lines, and also takes care of the business for the lumber districts which are convenient to it. Heretofore it has been the engine terminal for all road engines, both freight and passenger, for the Chicago terminal division. The suburban engines are stalled at 12th street and Stewart avenue. Under the new arrangement all freight engines will be taken care of at Hawthorne yard, west of the city, where suitable facilities are being prepared. Western avenue yard will then have all of the passenger engines, including the suburbans, and its own switch engines and those serving the lumber districts. Western avenue yard is to be entirely rearranged, and although there will be no enlargement, it is expected that its capacity for handling the business for which it is especially designed will be practically doubled. The yard trackage is slightly less than 26 miles, and this will not be materially changed in amount. An ordinance is now pending for connecting the elevation work here described with the section to the west of this, the eastern end of which is just across the P. C. C. & St. L. tracks from Western avenue. This stretch is 1¾ miles long and was done in 1898 and 1899. The ordinance mentioned also includes elevating all the north and south tracks just west of and parallel to Western avenue. These include four main tracks of the P. C. C. & St. L., two of the Chicago Terminal Transfer, two of the Chicago Junction and three of the Burlington. The latter extend only to 26th street, while all of the rest are to elevate to south of 31st street to connection with work already done.

The Burlington 16th street work is under the supervision of Mr. W. L. Breckenridge, Engineer of Lines East of the Missouri river, Mr. F. L. Stone, Engineer of Track Elevation, being immediately in charge. Mr. C. H. Cartlidge, Bridge Engineer, has charge of the bridge work.

A British View of Stock Watering.

Mr. Robert Fleming, an English banker who participated in several American reorganizations and has watched the situation closely, with the advantage of a distant viewpoint, is quoted as follows by the *Statist*:

Condemnation seems to center on the case of the reorganization of the Chicago & Alton; without, so far as I can see, any just grounds. This transaction took place eight years ago. I was myself a member, and so were many others abroad, of the syndicate which purchased the Chicago & Alton, and which represented practically all the stock of the company. Though its members had nothing to do with the scheme of recapitalization, that syndicate got the benefit of past earnings, which had been withheld from the stockholders and put into the property as well as the profit on 3 per cent. bonds bought at 65 and the doubling of the capital stock. The whole profit on the syndicate, which implied a lock-up for twenty months after charging the account with interest, was only 8 per cent. on the money, about 5 per cent. per annum—nothing very extraordinary, surely. We sold our bonds and stocks at the high prices then prevailing for everything. Had the bonds and stocks received been held till now there would have been a heavy loss.

The assent of both houses of Parliament in England has more than once been given to operations by which the ordinary stock of English railroads has been converted from £100 of ordinary stock into £100 of preferred converted ordinary bearing a low rate of dividend, and £100 deferred converted ordinary, thereby doubling the amount of the original stock. There is no essential difference between that operation and the Chicago & Alton plan. Doubling the capital does not double the value. Chicago & Alton preferred is quoted to-day at 59 per cent. and the common at 16¼ per cent. In England the idea was that the conversion gave in the preferred a medium for the less speculative part of the community, and in the deferred ordinary for the more speculative, it being thought that the two things would sell in the market at something more than the undivided stock. The idea has, I think, been largely exploded, and I doubt whether $20,000,000, Chicago & Alton common stock would not sell as well as the $40,000,000 of the two stocks. The Alton pays 4 per cent. on its preferred, and is said to earn as much on its common, and yet the two stocks together sell only in the eighties. The doubling of the stock was a mistake; but in any case it does not increase the revenue one cent. Our Midland Rail-

way, whose ordinary capital was thus increased from £38,000,000 to £76,000,000, cannot on that account get from freight or passengers higher rates and fares than the London and North-Western; nor, if it is ever bought by the Government, will the price be increased one penny.

It seems to me that in condemning watered capital the American public are led by theorists. If a law prohibiting the issue of stock unless for par in cash had existed in that country in the past, many of what are now big systems would never have been built, and if in the future the capital of railroads is to represent no more than the money spent, it follows that no new railroads will be built, unless by existing dividend paying systems.

Annual Report of Florida Railroad Commission.

The state railroad commissioners of Florida, R. H. Burr, J. L. Morgan and N. A. Blitch, have issued the tenth annual report of that body. The general railroad situation in Florida is bad. There have been "almost daily delays in both freight and passenger trains, causing great inconvenience and damage," and the freight train service has been "the worst ever known in the state." The use of heavy engines and cars on poor track is given as a principal cause of the poor service. The railroads also have insufficient docks at their seaport terminals and have not sufficient engines or cars. Shippers are constantly complaining, but they are disinclined to make formal charges. Two pages of the report are filled with a list of the fines which have been imposed by the commission on the railroads of the state during the year. Suits are pending to compel payment of the first five in the list, and against most of the others there is a note that the Attorney-General "has been requested to enter suit." Several fines for failing to bulletin passenger trains have been paid. The commission is not discouraged at the refusal of the companies to pay fines, because their imposition "has been worth many times more to the shippers of the state than the fines in themselves amount to." The suits concerning fines and other matters pending in the courts are set forth at considerable length in the report. Concerning new railroads and projected lines the report has the following notes:

The Atlanta & St. Andrews Bay, in operation from Dothan, Ala., south to Domer, Fla., 36 miles, is building an extension south through Jackson and Washington counties to Panama City on St. Andrews Bay, 49 miles. The Seaboard Air Line is extending the Tallahassee, Perry & Southeastern, formerly the Tallahassee Southeastern, from its present eastern terminus at Covington southeast to Perry, about 20 miles. The Charlotte Harbor & Northern is being built from Arcadia, De Soto County, southwest to Deepwater on the Gulf at Boca Grande, 58 miles. The Apalachicola Northern is building a line to connect River Junction (Gadsden County) and Quincy with Apalachicola, and will reach Deepwater at St. Josephs Bay, about 100 miles, is nearing completion. The Tampa Northern has secured control of the Brookville & Hudson, and proposes to extend its line from Tampa north to Thomasville, Ga. The work to be completed within 18 months.

The report contains the freight tariffs, demurrage rules and other regulations prescribed by the commission, and the usual statistics.

The Rehabilitation of the Brooklyn Rapid Transit Company.

The Brooklyn Rapid Transit Company is a holding corporation controlling through ownership of stock or by lease through constituent companies, elevated and surface lines with 557 miles of single track. These lines at one time or another during the last 50 years have been owned by nearly 60 different railroad corporations, but by foreclosure, reorganization, lease, consolidation or merger have been resolved into 10 constitutent companies. With few exceptions the lines are operated under lease by the Brooklyn Heights Railroad, all of the stock of which is owned by the Brooklyn Rapid Transit Company. To quote Col. T. S. Williams, Vice-President of the company, it is "the most varied collection of transit undertakings ever assembled under one corporate roof—horse railroads, cable railroads, electric railroads, elevated railroads, municipally owned and operated railroads, steam railroads, successful railroads, bankrupt railroads, railroads in public streets, railroads on private rights of way—a joint museum and hospital of corporate relics."

The development of the system down to 1899 may be divided under three heads, surface street railroads, surface railroads on private rights of way (originally steam railroads) and elevated railroads. The first surface street railroad was the Brooklyn City Railroad, incorporated in 1853. This was followed by the incorporation of a number of other surface street railroads during the next 15 years. The franchises given these companies were perpetual and were usually offered to the bidder who would agree to carry passengers for the lowest rates of fare. The growth of horse-car lines was gradual up to 1893, when electricity was first substituted as motive power. From 1893 until 1898 there was a big demand for surface road franchises both on the part of existing companies and by new corporations.

In 1862 the first steam railroad line was built from the outskirts of the old city of Brooklyn to Coney Island, and a number of these roads to other seashore resorts were built in subsequent years. They were incorporated under the general railroad law of 1850, were operated by steam and were generally subject to the regulations governing all steam railroads as to rates of fare, etc. They occupied private rights of way acquired by purchase or condemnation or, in some cases, the routes of old plank road companies. Because these steam railroads did business only in the summer time they were not highly profitable. They were subsequently merged with the surface and elevated lines. After 1893 most of them were changed from steam to electric operation, and the street and elevated roads with which they were connected were thus extended from the city to the outlying resorts.

The first elevated railroad in Brooklyn was chartered in 1874 and opened for operation in 1885. Subsequently a large mileage of elevated track was built. In 1899 the work of converting the elevated lines from steam to electric operation was begun.

The network of surface and elevated lines built at different times by many different companies naturally bore little relation to each other. Franchises for these early roads were granted indiscriminately and often unwisely. Some sections of the city had an overabundance of transportation facilities with several surface car lines paralleling each other closely, and with elevated lines besides; other sections of the city were without transit facilities of any kind. There was great confusion and congestion in the business district, and in particular at the Brooklyn Bridge, to which a majority of the lines led. Instead of competition's giving good service, the conflict of interests prevented any attempt at rearrangement and betterment.

In 1893 the Long Island Traction Company, the forerunner of the Brooklyn Rapid Transit Company, was incorporated. The property of the Brooklyn Heights Railroad, the Brooklyn City Railroad, and the Brooklyn, Queens County & Suburban were taken over under lease, but the results of the consolidation were not what had been expected, and in 1895 the Long Island Traction Company was sold under foreclosure to the present Brooklyn Rapid Transit Company. The system was extended by lease and purchase of one or two additional subsidiary companies of little importance, and in 1898, 266 miles of single track (first track, second track and sidings) were under the control of the B. R. T. through ownership or lease of five constituent companies. In 1899 eight more companies, including the Brooklyn Union Elevated, the Kings County Elevated and the Nassau Electric Railroad, were taken over, which with 53 miles additional added by purchase and by extension of old lines during the last seven years, have increased the single-track mileage to 557 miles. The Brooklyn Rapid Transit now comprises 10 constituent railroad corporations either leased or with complete stock ownership vested in the holding company.

The capital stock of the Brooklyn Rapid Transit Company was originally $20,000,000. In 1899 it was increased to $45,000,000 in order to provide for taking over the additional lines purchased at that time. Some of the roads taken in were in good condition and were profitable; others were badly run down and had but little earning power. The company attempted to handle the big problem which had been undertaken and to increase its facilities to keep pace with the rapid increase in population of the city. In the three years, 1895 to 1898, before the acquisition of the new lines, it had spent out of capital $1,267,814 on tracks, $206,623 on buildings, $87,092 on power house equipment, $76,238 on miscellaneous improvements, and $519,000 on new cars and car equipment, a total of $2,156,767.

With the taking over of the new companies in 1899 came further large necessities for spending. Before the consolidation the elevated railroads had been investigating the possibilities of electric traction. They had been led to do this by the great increase of travel which followed the extension in 1898 of elevated service across the Brooklyn Bridge. The cost of electrification and the rebuilding which electrification involved fell upon the new owners. The surface cars had begun to run across the bridge late in 1897 and this traffic had already grown remarkably, making necessary large improvements to the surface lines. The city of Brooklyn was beginning to grow rapidly as another result of the same cause, and this growth called for funds for extensions of the existing lines to reach the new outlying districts which were being built up. In 1900 came the necessity for another expense, the electrification of the steam roads running to the various seashore resorts. This also involved large costs, including that of abolishing grade crossings.

In 1900 the proceeds from the sale of $6,000,000 bonds were available for these improvements. In the year ended June 30, 1900, 585 new cars were bought. After competitive experiments and trials lasting over two years, in 1902 a contract was made for complete electrification of the elevated roads. In this change of motive power the Brooklyn Rapid Transit took the lead in its territory, its installation being second only to a short stretch of elevated track in Chicago and an electric traction operation in London. The

company did not, however, have sufficient capital to carry out these extensive improvements as they should have been managed, and a great deal of its effort was misdirected.

By July 1, 1901, the available funds had been used up and expenditures had to be stopped. The natural consequence was that the partially finished improvements made small return in greater efficiency of operation and that the transportation service on both the elevated and surface lines, instead of improving, grew worse. The tremendous increase in business over the Brooklyn Bridge continued and the problem of handling the traffic grew more and more difficult, so that the company, however unjustly, came in for most, if not all, of the public indignation at the disgraceful crowding which prevailed at both ends of the bridge. The city authorities, on the other hand, failed to co-operate in any attempt to improve these conditions. On this account, and because of the lack of funds, the company was compelled to adopt the general principle of doing nothing. With a property which for years had been suffering the gradual processes of decay and which had had to meet tremendous increases in traffic without corresponding improvements, this stopping of betterments and necessary repairs naturally resulted in a deplorable condition in almost every detail of the working plant.

By the end of 1901 the property was in a thoroughly bad state. Large numbers of cars were old and out of date, the power plants were inadequate, the track structure in the streets, never having been perfectly bonded, was a constant source of loss of power, and the elevated structures were dilapidated and in places unsafe to carry the longer and heavier electric trains which were about to be put in operation. The interlocking plants at elevated junctions were antiquated and of little or no use as safety devices. Some wooden sheds 25 years old at the end of a wooden trestle were the repair shops for the 400 or 500 elevated cars. Because of lack of car barns, surplus cars were stored at night in the streets. When a neighborhood objected the cars were stored in some other locality. Offices were scattered all about the city with the naturally resulting poor organization.

These instances are typical of the condition of the property early in 1902. At that time Edwin W. Winter, formerly President of the Northern Pacific, who had been called in by the directors in an advisory capacity, urged the necessity of at once spending at least $25,000,000 in putting the property, which had been supposed to be in fairly good condition, on its feet. It was not a case of spending this large amount in the most economical way over a period of years, but of putting it into the property with the utmost despatch. A refunding mortgage of $150,000,000 was authorized March 20, 1902. Of the proceeds from the sale of these bonds a sufficient amount was to be reserved to refund the bonds of the Brooklyn Rapid Transit Company and of the subsidiary companies as they fell due, and the remainder used in acquiring additional properties and carrying out improvements and extensions. This mortgage was filed on July 1, 1902, and the first proceeds from the sale of $5,000,000 of the refunding bonds became available in October of that year. In February, 1903, Mr. Winter was elected President and the task of rehabilitating the property placed directly in his charge.

It was a large work which the new President undertook. Complete reorganization, far-reaching reconstruction and extensions were necessary. Not only had many of the existing lines to be rebuilt, but the different elements of the system, widespread and unrelated surface, elevated and steam lines had to be brought into such relation with each other that they would all fit into a comprehensive system of transportation to meet the fast growing increase in travel. The demand for rapid transit had for years been forging ahead of the available facilities faster and faster. The problem was not alone to provide increased facilities to keep pace with the growing population, but as well to make up for the years of lost time and misdirected effort. Many of the improvements which had been made had to be rearranged, entirely rebuilt or abandoned. There was a shortage of cars, of power, of terminals and of those important adjuncts of such a city transit system, storage and repair facilities. The elevated roads in many respects were worse off than the surface lines, for the work of reconstruction from steam to electricity had been only partly finished.

It is not possible to take up the improvements in their chronological order. While most of them were of major importance, equally imperative, there were many delays in acquiring property and obtaining permits which prevented their completion in order of necessity. They may better be divided into three general heads: shops and yards; terminals and structures; power houses and new equipment; in which order they will be considered here.

When the change was made from steam to electricity on the elevated lines a large number of new motor cars were bought and most of the old steam equipment rebuilt. All of the work of wiring, putting in motor trucks and strengthening and repairing the old car bodies was done by the company. The existing shop and yard facilities for doing this work and properly caring for the equipment in service were such old shop buildings and trestles as had been handed down from steam operation or temporary buildings built on extensions of the elevated structure. Electric equipment requires careful and regular inspection and prompt repair to be kept in safe running condition, and one of the first improvements begun was the construction of suitable inspection and storage yards with shops for making repairs.

The elevated lines are in two groups, the southern district and the eastern district. The southern group includes all the lines which run to Coney Island over the Fifth avenue elevated structure and also the Brighton Beach line. The eastern group includes the Fulton street, Lexington avenue, Myrtle avenue and Broadway lines, all of which, except the Myrtle avenue line, come together at East New York. There had formerly been elevated shops at East New York serving the eastern district and a small shop at Thirty-sixth street and Fifth avenue, where the Culver and Sea Beach lines to Coney Island leave the elevated structure. Large modern shops and yards were planned at these two points.

At Thirty-sixth street and Fifth avenue, the old building which was originally the Union passenger station where passengers were transferred from the elevated and surface lines to the cars of the old Prospect Park & Coney Island Railroad, was abandoned as a station and entirely rebuilt as part of the new shop plant. The old connection from the elevated structure to the Culver line, over which elevated trains ran to Coney Island, was removed and in grading for the storage yard an incline on an earth fill was built south of the yard leading to the elevated structure with two tracks around a sharp curve. A separate shop track connects with the storage yard ladder.

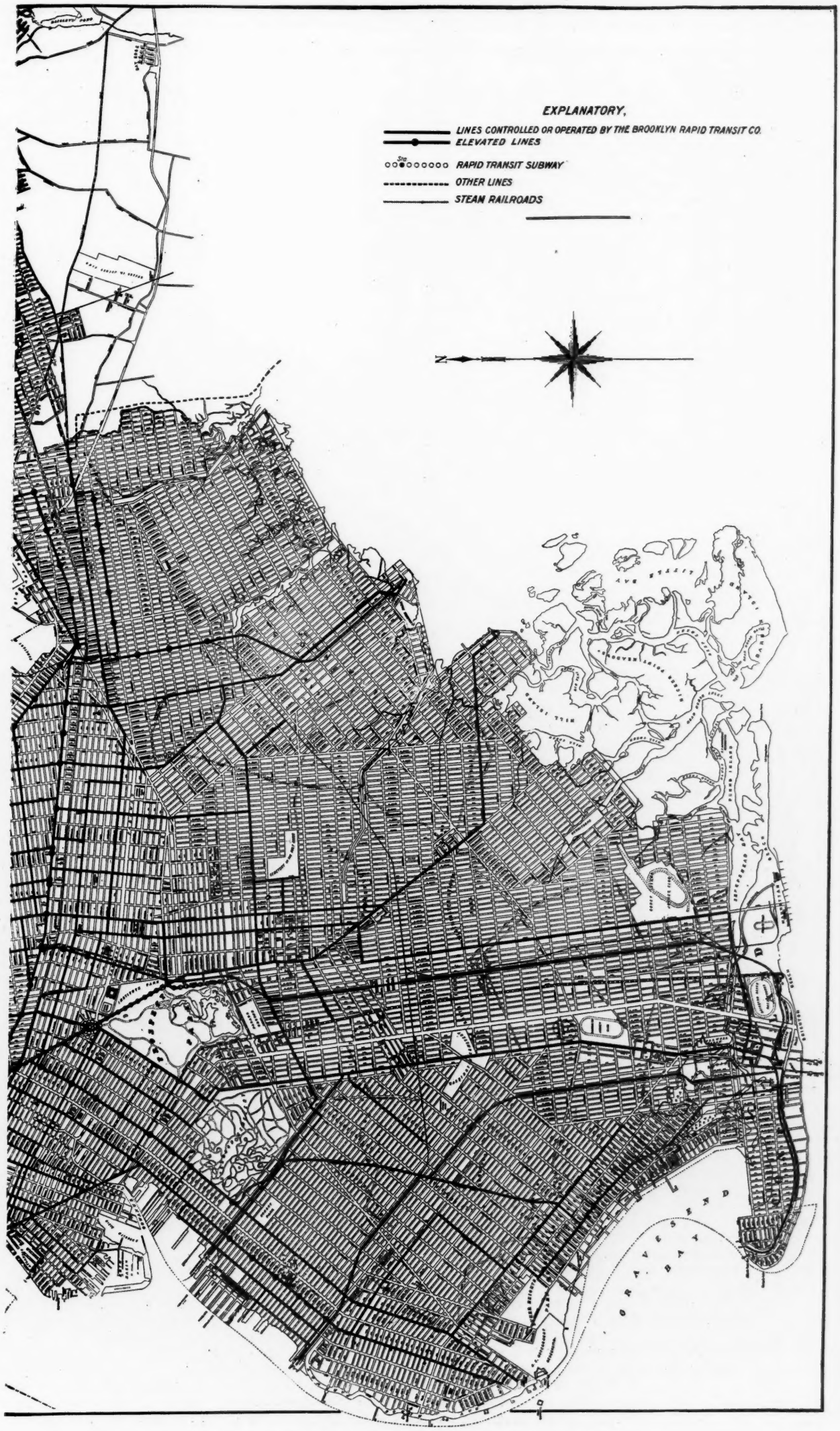
The old station building was remodeled into offices, locker rooms and carpenter shop on the ground floor for the shop employees and officers, and locker rooms and recreation rooms for the operating department on the second floor, which is on a level with the elevated structure. The boiler room and machine shop are in an addition to the old building. On a level with the ground floor and in the rear are the 10 inspection pits, which are completely enclosed. The structure covering the pit is fireproof and separated from the shop building by a heavy firewall. The roof is of the saw-tooth type supported by steel trusses on iron columns. This gives good light and ventilation. The pits are reinforced concrete, about 4 ft. deep and long enough to take a six-car train. The hot air heating system is used in connection with the pits for melting snow and ice and drying out the machinery. One of the pits is equipped with a hydraulic drop table for removing and replacing trucks to be repaired. These are dropped to the level of the machine shop floor and run into the shop on a track served by an overhead traveling crane which is used for dismantling. All cars on the southern district lines are taken in the shops here once every three days for inspection and light repairs, and once in 30 days are brought in for a thorough overhauling of trucks and electrical machinery. The end of the shed is closed with steel rolling doors and the tracks lead out to the main storage yard, which has a capacity of 340 cars. Overhead trolley wires instead of third rail are used in the yard and inspection shed, as south of Thirty-sixth street the elevated trains running through to Coney Island are operated by trolley. This plant has been in operation only a few months. The old shops—temporary sheds built on trestles to the west of the structure—have been torn down and the space is now used as a spare storage yard when required. This shop and yard cost $309,000.

At East New York the company has built for the eastern district even more complete shops and storage yards, which are also used as construction shops and storehouse for the entire system. They are located on an irregular piece of land between Bushwick avenue, Gillen place and Broadway, and have direct connection with the East New York loop, which joins the Broadway line to the Fulton street line. The ground slopes away from Bushwick avenue towards Broadway, and much of it had been filled in in irregular ridges covering old wooden trestles on which the shops and storage tracks for the steam elevated trains had been built. These shops were dilapidated frame buildings, firetraps, and utterly unsuitable for electric equipment.

Before leveling off this tract a massive concrete retaining wall was built enclosing the space for the shop building at the corner of Bushwick avenue and Gillen place. The space so enclosed was excavated down to the level of Broadway for the lower floor of the shops, which include the machine shop, smith shop and armature shop. On the second floor, which is on a level with the elevated structure, is the wood working and paint shop with drop elevator for lowering the trucks to the machine shop below. North of the shop building and on the second floor level are the eight covered inspection pits each long enough for a six-car train and similar in construction to those at Thirty-sixth street. All cars are inspected every three days and overhauled every 30 days. This building is separated from the main shop building by a heavy firewall supported on the main retaining wall. North of the inspection pits are storage tracks with a capacity of 264 cars. There are 12 tracks in three bays of four tracks each. Each bay is separated from the next by a hollow tile firewall, extending up above the roofs of the cars. The elevated yard is now on a solid earth fill supported by retaining walls.

In connection with the shops is a two-story general storehouse

Map of the Brooklyn Rapid Transit Company's System (North Part).



Map of the Brooklyn Rapid Transit Company's System (South Part).

in which all shop and system supplies, including material for the track and signal departments, station supplies and electric equipment are stored. This building, like all the others, is of the most approved fireproof construction with brick walls, reinforced concrete floors and roof, and protected columns.

A surface storage yard has also been built here, which will hold 327 of the largest size trolley cars. The tracks are arranged in pairs with fireproof walls between. An old building to the south of Gillen place is used for inspecting and making running repairs to surface cars stored at this point. The club building of the Brooklyn Rapid Transit Employees' Benefit Association also occupies part of the company's property on Gillen place. A reinforced concrete building with an entrance from the elevated structure has been built for a train despatcher's office and locker rooms for the employees of the operating department.

On the south side of Gillen place there is an incinerator plant built to dispose of city refuse. The Brooklyn Rapid Transit has a contract with the city for disposing of ashes and other refuse, except garbage. The refuse is collected by carts and brought to several loading stations. Ashes are loaded on cars and hauled to the marsh lands back of Coney Island, where they are used for filling in. Combustible refuse is sent to the incinerator at East New York or to a similar plant run in connection with the Central power plant at Third avenue and Fourth street. At the Central power plant the steam generated in the boilers of the incinerator is used to heat the boiler feed-water, but at East New York it is used for heating the shops and supplying steam to the hammers in the smith shop. More than $700,000 has been spent on the improvements at East New York which are now, with the exception of a sub-station under construction, entirely completed and in running order.

These two new shop plants built within the last three years at a cost of over $1,000,000 are typical of the improvements made under Mr. Winter's administration. They are examples of the most modern and efficient electric railroad shops in the country. The general public does not appreciate the value of such improvements in bettering the transportation service, yet they are the controlling factors in the safe, comfortable and reliable operation of electric street and elevated cars.

(To be concluded.)

The Union Pacific Gasolene Weed Burner.

Keeping the right-of-way on branch lines free from weeds during the summer months is a troublesome matter to many railroads. On many branch lines, along sidings and commercial tracks that are infrequently used, the roadbeds are ballasted with dirt, and from early spring until late fall the rank growth of weeds is a source of great annoyance and considerable expense. It is a common sight on such roads in the western prairie country for the weeds to be 2 ft. or 3 ft. high, and on commercial tracks seldom used, sunflowers and other rank growths are seen as high as 7 and 8 ft. along both sides of the track. This condition obstructs seriously the movement of trains, causes slippery rails with consequent annoyance in operation, and necessitates considerable reduction in tonnage and thereby a decrease in revenue.

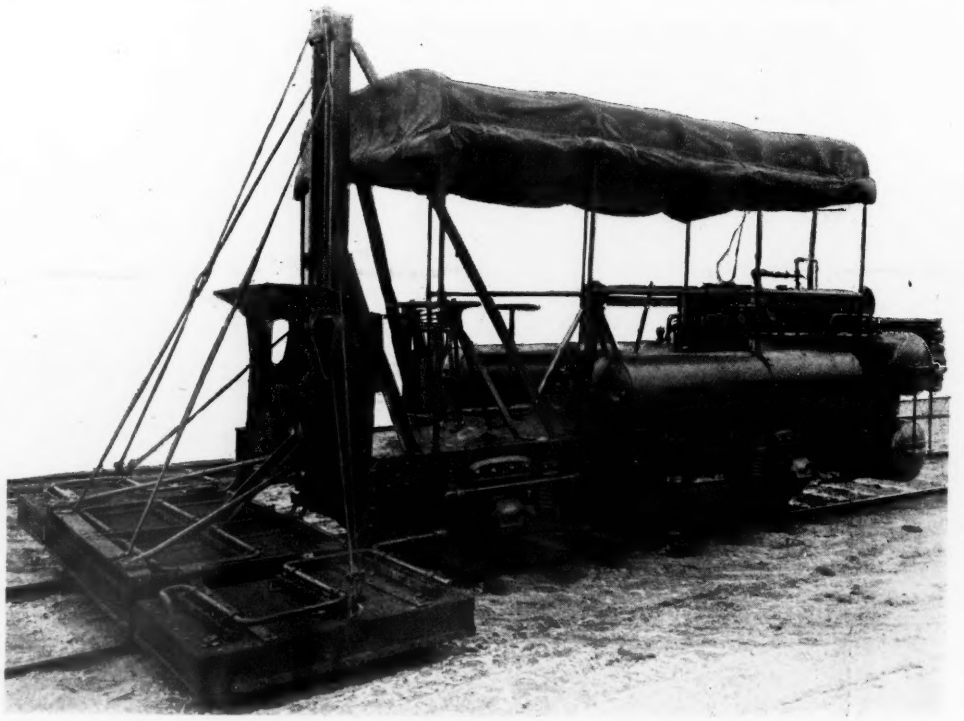
It is absolutely necessary to get rid of this growth at any cost. The pilot of the locomotive has been made use of to some extent by fitting it with knives, but this has not been of much benefit, and in the main it has been necessary for the track department to engage large gangs of men to cut this growth at great expense with scythes and shovels. This cost is practically continuous throughout the summer months, as the growth is as fast as a reasonable number of men can keep pace with. The season at which this work must be done is also the time when laborers are in great demand in the fields, and it is often almost impossible to get the men at any cost during this period. Since on these branch lines the traffic is usually relatively light, the operating officers often begrudge this unproductive outlay for labor.

A year ago the Union Pacific Railroad set about finding some means of doing this work at a minimum cost. Many suggestions were considered, such as cutting the weeds by machinery and sprinkling the right-of-way with a saturated solution of salt and water, which would tend to kill off the weeds; but after numerous experiments in the way of machines for the work, A. L. Mohler, Vice-President and General Manager, suggested a gasolene weed burner. One was accordingly developed in the Omaha shops under the direction of W. R. McKeen, Jr., Superintendent of Motive Power, and has been doing the work very successfully and at greatly reduced cost. It is carried on a four-wheel all-steel car with regulation standard wheels, axles, boxes, pedestals, etc. At one end of the car is a gasolene engine secured to the floor, which propels the car and pumps the air for forcing the gasolene to the burners and elevating the side wings of the burner frame. The propelling mechanism is designed for two speeds, the slower speed of 3 to 4 m.p.h. being used while burning weeds, and the higher one of 12 to 15 m.p.h. in going to and from work.

There are a number of tanks on the car to carry a supply of gasolene sufficient for a day's run on the road. The gasolene is forced by compressed air into a system of burners at the back of the car, arranged to deliver the flame close to the ground. This practically kills the weeds, while cutting them in no way stops the growth, of course. The framework for carrying the piping to which the burners are secured is divided into three sections, the center one of which extends a little beyond the rails. The side sections are hinged to the center section to enable them to be lifted out of the way of obstructions outside of the track and to clear cattle-guards, etc. They can also be set at any elevation in order to bring the burners close to the ground on any kind of grading. With these three sections in operation a strip 12 ft. wide—3½ ft. each side of the rails—is cleared.

It has been found advisable to make a first burning early in the year when the growth has reached a height of 6 to 8 in.; then to go over it again a few days later when it has dried somewhat. In the second burning the weeds are entirely consumed and the roots killed. It is sometimes necessary to repeat this performance three months later. The machine is capable of burning from 20 to 25 miles a day, running about 3 to 4 m.p.h. Three men, all told, are required in the operation of the device, the car being moved over the road under orders the same as a regular train. Where the weeds are cut by hand it requires approximately 16 men to cut one mile of track per day, hence the machine does the equivalent work of about 300 men. It destroys the weeds at a cost of $5.74 per mile as against $22.40 per mile when cut by section men.

This solution of what was previously a difficult problem to the Union Pacific thus proved a simple matter. The gasolene weed burner is in reality an automobile mounted on railroad car wheels, equipped with the weed-burning apparatus. It carries the fuel for the burners as well as for its power, and its operation is so simple that it is comparatively easy for one man to handle it. It is said that in good weather a trip through the country on this weed burner is a very pleasant ride.



Union Pacific Gasolene Weed Burner.

At eight large stations on the Government railroads in Japan tablets are hung up "to provide means of writing reminder for such of the passengers who have anything to communicate to their fellow travelers who do not arrive in time."

Economy in Power.

BY A. STUCKI.

Year by year power driven machines are steadily substituted for hand labor. Competition in every branch of industry, railroading not excluded, becomes more severe every day, and, besides that, the tendency of the present age points toward a further development in every branch of industry and science. But in order to succeed properly in all the different stages in this onward march, the fundamental question should constantly be borne in mind, *i. e.*, How can we get the maximum power from the fuel stored up in the ground?

Not so many years ago this question could have been answered with comparative ease, then being only a matter as to what design of boiler and engine equipment would give the best results. To-day, however, the question is more complex, as in addition we will have to consider the steam turbine and the gas engine, with a number of closely related devices—the oil, gasolene and naphtha engines. Even in the steam equipment itself we have possibilities in fuel which we formerly did not make use of, namely, oil and pulverized coal.

First, let us take up the question of relative economy in fuel, what it means in heat units and what it means in dollars and cents. It is not the intention, however, to go into theoretical deductions and scientific researches, but simply to state some average figures which, although based on practical results and on experiments, may not be absolutely correct, but one sufficiently so to form a guide in the selection of the power system in laying out a shop or extending an old one.

To begin with a steam plant, it is a well-known fact that the losses in energy are very great. For clearness sake, let us consider a 1,000-h.p. installation, return tubular boiler, bituminous coal (Pittsburg) at $2.50 per ton delivered, 13,000 B. t. u. per lb., high speed, non-condensing engines and 160 lbs. of steam pressure. The losses in the boiler average about 40 per cent., and are mostly due to imperfect combustion, loss of heat by the escaping gases through the stack and loss of coal in the ashes, and, therefore, instead of evaporating 12.8 lbs. water from 212 deg. to 370 deg. 7½ lbs. is a fair average, for service conditions. Mechanical stokers, down draft furnaces and economizers are often used to increase the efficiency. The latter device alone is said to improve the result nearly 5 per cent. The feed water is often treated so as to prevent the formation of scale in the boiler, and it was also found that heating the air before it enters the firebox is beneficial, but if we consider that it takes about 20 lbs. of air for every pound of coal burnt, it is easily understood why this is not done in practice.

It makes little or no difference whether the heat strikes the flues from the inside (fire tubes) or whether the water in the tubes (water tubes) is heated from the outside, except that the danger from explosions in the latter case are lessened. This point will be touched on later.

To increase the efficiency of the boiler, other fuels besides coal have often been tried.

Oil burned with compressed air or steam, to spray the same, produced quite satisfactory results, and one pound of fuel oil containing 19,000 B. t. u., costing 47 cents (3¼ cents per gallon), may be looked upon as evaporating 11 lbs. of water, under the circumstances mentioned above. This means that a pound of fuel costs 320 per cent. that of coal and evaporates only about 47 per cent. more water. Besides this, it must not be overlooked that the oil market is subject to sudden fluctuations, while the coal is not.

Pulverized coal has also been used with good success. Coal, in this case, is dried and then ground to powder. However, when crushed very fine and suspended in air, it forms a high explosive, and for this reason coal is only ground medium fine. Still, a very good combustion can even then be obtained. An average of about 8¼ lbs. of water being evaporated per lb. of coal dust, conditions being the same as mentioned in the beginning, and if the extra cost of the drying, grinding and conveying machinery is not considered, pulverized coal would certainly be a cheaper fuel than ordinary coal.

Arriving at the second item of a steam plant, the engine, we know, that for every 2,544 B. t. u., theoretically speaking, we should obtain a horse-power for an hour. Instead of that it takes 26 lbs. of steam at 1,014 B. t. u. each, or 26,364 B. t. u. in all, which is equal to 2,544:26,364, or 9.7 per cent. efficiency. Some of these losses are due to cylinder clearance, cylinder cooling and loss of energy in the exhaust steam. The amount of fuel needed is 26:7.5 = 3.5 lbs. of coal, or 0.4375 cent per h.p.-hour, or $13,125 per 1,000 h.p.-year, the year being counted as 300 days, 10 hours each.

By compounding or expanding, triple or quadruple, also by installing condensers, it has been possible to reduce the steam consumption to about 16 lbs. h.p.-hour, which, in connection with the boiler first mentioned, means 2.3 lbs. of coal per h.p.-hour, or .2875 cent 1,000 h.p.-year, in this case will cost $8,625. (With this kind of an engine the feed water will be much cooler, when entering the boiler, than with a high speed engine, hence by right the boiler cannot be expected to evaporate quite as much water as before.)

Of late the steam turbine has come right to the front. Notwithstanding the facts that this machine is very compact, and void of complicated valves and reciprocating parts, it is about as economical in steam consumption as the high duty engine, whose place it takes. It can successfully be used with and without condenser; however, the best results are obtained by superheating the steam.

Taken as a whole, the efficiency of the steam plant is very small, to put it light, and it certainly is a relief to know that the gas engines of to-day are able to do much better. The underlying principle consists in introducing the fuel in a gaseous form directly into the cylinder, mixing it there with air until a highly explosive gas is obtained, after which it is ignited. The blow of this explosion is then directly absorbed by the piston. By such a method it is plain that a very much higher efficiency can be obtained than in the steam engine. It is also plain that, in case of natural gas being used, the great losses inherent to the steam boiler are entirely done away with, and last, but not least, the gas engine enables us to make use of valuable gases which heretofore went to waste, thus not only doing away with losses in the efficiency, but actually doing away with the fuel bill. This has reference principally to coke oven and blast furnace gases.

On nearly the same principles are based the naphtha, gasolene and oil engines, the fuel simply being caused to evaporate before being brought into the cylinder. After this is done, the functions are the same as we find them in a gas engine. These engines in small units do good work in various capacities throughout the country, but, as mentioned before, the price and the market conditions of these fuels would exclude them for large installations.

Inasmuch as the coke oven gas has a high calorific value, over 600 B. t. u. per cubic foot, it forms a magnificent fuel for gas engines.

The blast furnace gases, on the contrary, are very much weaker, having but 90 B. t. u. per cu. ft. Nevertheless, it is estimated that for each ton of pig iron produced a sufficient amount of gas escapes to produce 600 h.p.-hour.

The natural gas of the Pittsburg district contains about 1,000 B. t. u. per cu. ft., and it takes about 10 cu. ft. to produce one h.p. for an hour. It takes about 10 cu. ft. of air for each cu. ft. of gas to make the explosive mixture. Gas at 15 cents per 1,000 cu. ft. will, therefore, result into 15 cents per h.p.-hour, or $4,500 year for 1,000 h.p.

One pound of Pittsburg coal will produce about 69 cu. ft. of producer gas of 144 B. t. u. each. Mixing the gas with about an equal amount of air will give an explosive mixture about 25 per cent. weaker than the mixture from the natural gas just mentioned, a fact which should be borne in mind in rating a gas engine. Taking the calorific value of the two gases as a basis of comparison, it will take about 68 cu. ft. of producer gas for each horse-power per hour, which, coal as above, will result in a cost of .1225 cent, or $3,675 per year for 1,000 h.p.

The figures so far mentioned are, for convenience sake, tabulated. They can very readily be adjusted so as to compensate for variations in the market prices of the different fuels.

Steam equipment.	Engine: High-speed.	Engine: Trip. expansn.	Gas engine equipment.	Gas: Natural.	Gas: Producer
Kind of fuel	Coal.	Coal.	B.t.u. per cu. ft.....	978	144
Boiler pressure, lbs..	160	160	Air used, cu.ft. of gas	9.7	1.2
Water evap., lbs. coal	7½	7	B.t.u. per cu. ft. of expl. mixture.....	91	65
Efficiency boiler,pr.ct	60	60	Gas, per lb. coal,cu.ft	..	69
Using condenser....	No.	Yes.	Efficiency of producer in per cent...	..	76.4
Steam pr h.p.,hr.,lbs.	26	16	Gas used,h.p. hr.,cu.ft	10	68
Efficiency of engine.	9.7	14.1	Efficiency, eng., p.ct.	26	26
Total efficiency	5.5	8.5	Total efficiency	..	20
Fuel, per h.p. hr., lbs.	3.5	2.3	Cost:		
Cost of fuel:			1,000 cu.ft. gas, cts	15	1.81
Per ton	$2.50	$2.50	Coal per ton.....	..	$2.50
Per h.p. hour.....	.4375	.2875	Fuel per h.p. hr.,cts	.15	.1225
Per h.p., per year..	$13,125	$8,625	Fuel, per 1,000 h.p. per year	$4,500	$3,675

Fuel economy, however, is by no means the final goal of engineering, but simply one item toward getting a maximum service in a certain given time for the least amount of money. Therefore the following points should likewise be considered:

Cost and maintenance of installation.
Reliability.
Safety.
Attendance.
Adaptability to various conditions.

Comparing first the installation necessary in a steam plant with that of a gas engine it will not be hard to recognize a tremendous difference in favor of the latter. With the boiler and engines, we have to provide stokers, stacks, feed pumps, feed water heater, coal and ash conveyors, expensive piping, coal bins, water softeners, economizers, and, in high duty work, condensers, while with the gas engine, disregarding coke oven gas, blast furnace gas and natural gas, as special cases, nothing is necessary, except the gas producers with their scrubbers, and coal and ash conveyors. It goes without saying that the initial cost of a gas engine plant is much less than the steam plant outfit, and, speaking in a general way, the maintenance of a few details amounts to less than a good many.

It is true a good many gas engines have been tried, abandoned

and replaced by steam engines on account of not having been found reliable, and an engine giving out just when possibly its service is most needed is very costly, no matter how low the fuel cost may be. But in justice to the gas engine, the writer must say that in all cases of this sort, which were brought to his attention, the conditions were such that nothing else but a failure could be expected. In one case of gas engine explosion, he found that it was one of the earlier designs and had been doing service continuously for over eight years, notwithstanding the fact that the man in charge pronounced it out of order and unsafe, but was compelled to run it, as there was no substitute at hand.

Right here is the secret of success. Can you expect any machinery to run continuously without provision being made for periodical overhauling and emergency cases? I have heard men say that their gas engines did admirably the first few months, and after that at once refused to work, giving constant trouble from then on. Such a statement is merely preposterous. Why not hunt up the reason for such a change, and remedy the trouble? On the other hand, I have seen gas engine installations run year in, year out, with the regularity of a clock, and all the engineer in charge insisted on was a periodical cleaning and inspection of the igniter and the other small details so essential in the gas engines.

Speaking about the relative safety of the steam and gas engine outfits, we all admit that there should be no danger in either, and there is no danger if everything goes as intended. But why is a high pressure fire tube boiler not to be tolerated in the basement of a well regulated office building? Why will steam cylinder heads burst occasionally? Because accidents will occur in spite of what you do. The same way with the gas engine. However, one redeeming feature is the absence of a boiler, beyond doubt the greatest source of danger.

Again, we often hear that any man can run a steam plant, while it takes an expert to run a gas engine. This is only partly true. It is much easier to find a man familiar with the steam equipment than to find one who is willing to study carefully the ins and outs of a new device, but after he has mastered the task he invariably will prefer the latter, simply because there is much less to attend to.

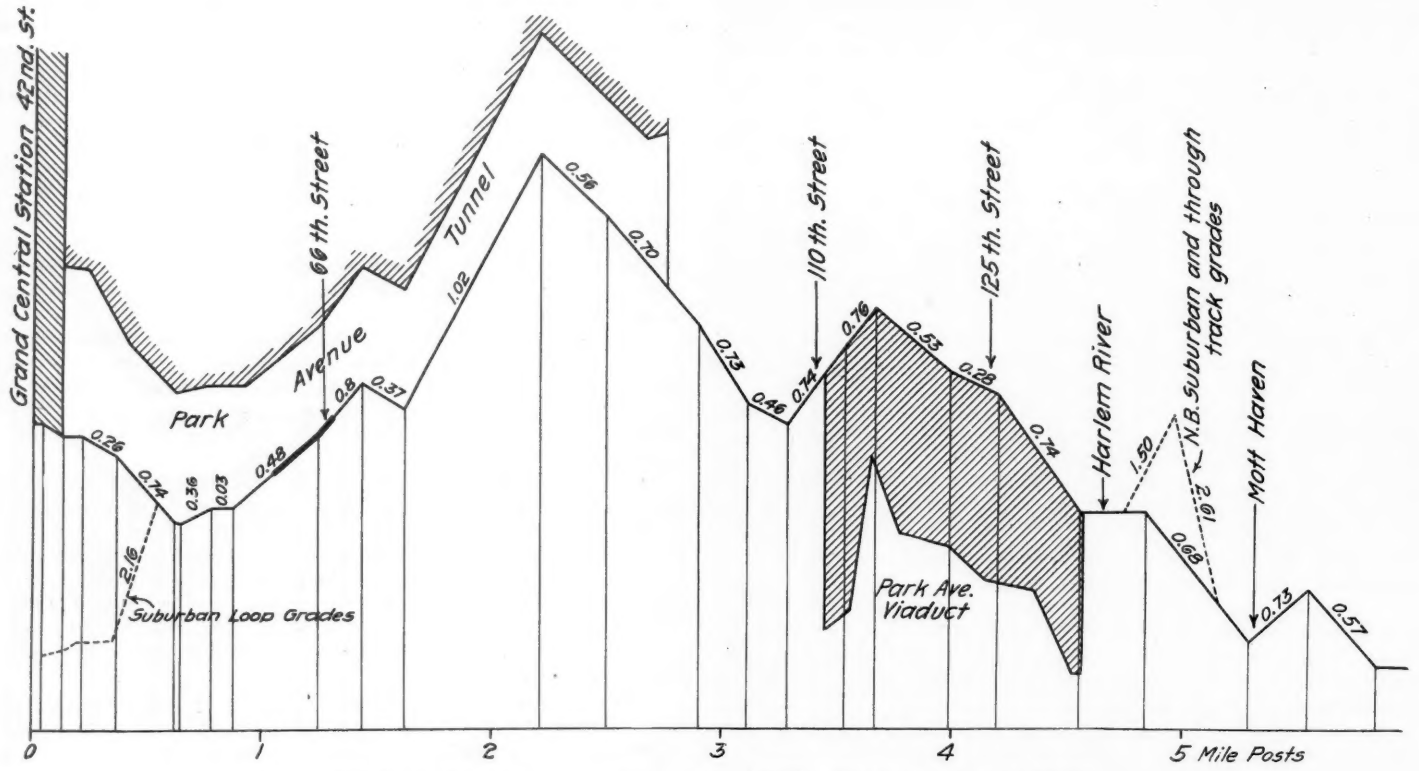
Often, it is true, steam is needed also for heating buildings. This can easily be provided by setting up an extra small boiler of low pressure near where the steam is needed.

Others may demand steam as a means for driving hydraulic pumps and air compressors. But we must not forget that it takes from 90 to 120 lbs. of steam for every horse-power per hour in a hydraulic pump, and the sooner we give up such wasteful practice the better. Electrically driven pumps are now kept in the open market. It is true they are more complicated, but look at the saving in power. Besides this, an electrically driven pump can be located near the presses or riveters, doing away with a great deal of piping and friction, and making the whole shop that much more flexible. The same thing can be accomplished by driving air compressors by electricity, and the location of the power house can be chosen solely with a view of minimum handling of fuel, entirely independent of the shops.

Tractive Power of Electric Locomotives.

On the afternoon of April 26, northbound train No. 19 (Lake Shore Limited), consisting of nine heavy Pullman cars hauled by a Central-Atlantic type steam locomotive, was disabled and stopped in the tunnel on the 0.5 per cent. up-grade under 66th street, New York City (see profile). Following this train was a local train of seven standard day coaches hauled by one of the new electric locomotives. The electric locomotive, coupled on behind No. 19 and pulling its own train, started the entire load on the grade without assistance from the steam locomotive, which was dead. The 16 cars and two locomotives weighed approximately 1,000 tons. The electric locomotive started with good acceleration and pushed No. 19 north to 125th street up the 1.02 per cent. grade one-half mile long from 72d street to 83d street, without any difficulty and at good speed.

Of the 477 trains daily now entering and leaving the Grand Central terminal, 135 are New Haven trains handled by steam locomotives, and the remaining 342 trains are New York Central. Of the 342 trains, 280 (equal to about 82 per cent.), are now handled electrically, and it is expected that the remaining 62 trains will also be handled electrically within the next week or two. The partial change to date has resulted in a marked improvement in the visual conditions in the Park avenue tunnel.



Profile of Park Avenue Tunnel; New York Central & Hudson River.

Central Railroad Office at Berlin.

The *Zeitung des Vereins* states that certain sections of the railroad work that have heretofore been handled by the individual companies in accordance with their individual ideas, but which, for the purposes of comparison ought to be handled in a uniform manner will now be taken care of in a central office that has been created in Berlin. The amount of work that has been imposed by the increase of traffic on the one hand, and the desire to simplify, accelerate and treat the business scientifically, on the other, has been the real cause of the establishment of this new department which began work at the commencement of the present fiscal year, April 1. This central office will report directly to the Minister of Public Works. It is to rank with the management of the railroads and will be called upon to decide for the whole system of State Railroads in all matters belonging to its jurisdiction just as these were formerly decided by the individual managements. The matters which will be controlled by it will be: (*a*) All affairs connected with the rolling stock, especially as regards freight cars and their utilization; (*b*) the construction and purchasing of all materials entering into the superstructure, safety appliances, locomotives and cars; (*c*) the direction of investigations and tests for improvements intended to increase the capacity and safety of railroad appliances, including rolling stock and other things used in the handling of traffic; (*d*) the purchase of important materials; (*e*) the elaboration of through service and a uniform regulation of train movement; (*f*) the distribution of applications for em-

ployment, and (*g*) the promulgation of a uniform system of beneficent institutions for all of the State Railroads.

Objects and Effects of State Regulation.*

In some of the states, owing, perhaps to a failure to understand the true relations of the railroads to the business of their communities and the identity of interests between the public and the roads, there is a tendency to regard railroads as different from all other business undertakings and as the proper objects of burdensome restriction rather than of helpful encouragement. This tendency is being manifested in legislation that would universally be recognized as destructive if applied to any other business. It has been carried to such lengths that thoughtful business men who recognize the importance of efficient transportation agencies to the success of their own business may well consider what are to be the final results. They may well give thought to what will be the ultimate effect upon their individual business undertakings of policies the tendency of which is to cripple the carriers and lessen their ability to provide service.

Is antagonism to railroads to be carried to the point that will destroy the properties, or only to the point that will cripple them? What will be the inevitable effect on the general prosperity of the country of either of these degrees of destruction? These are questions that every business man should ask himself and that he should propound to those responsible for enacting and executing legislation. If these questions are answered without prejudice it will be found that, in every case, legislation that goes farther than proper regulation cripples every business interest along the lines of the railroads affected as surely as it cripples the railroads themselves.

The phenomenal growth in the volume of business in the United States in the past few years has resulted in the demand for transportation increasing faster than the railroads have been able to increase their facilities. Just at this time, when increased facilities are of infinitely more importance than any possible reduction in either freight or passenger charges, legislative policies are adopted by some of the states the inevitable effect of which, if persisted in, must be to postpone or make impossible urgently needed railroad improvements and extensions.

Do not understand me as being opposed to such proper governmental regulation of carriers as is necessary to prevent discrimination and to assure reasonableness of charges. It is the legislation that goes beyond proper regulation and becomes destructive that should be condemned by public opinion, not only as a matter of simple justice and fair play, but in the interest of the public as well. That the belief that much of the current state legislation tends to destruction rather than to regulation is not confined to railroad men is shown by an interview with Chairman Knapp, of the Interstate Commerce Commission, recently published in the Chicago *Tribune*. Referring to the public antagonism to railroads displayed in some parts of the country, Mr. Knapp said:

> "To my mind, the most serious and difficult phase of the situation, and the greatest menace to the needed development of our railroad systems is the hostile attitude of the states. Serious trouble is likely to arise unless, by some means, tolerably harmonious action as between Federal and state authorities can be brought about."

In the same interview Mr. Knapp expressed the opinion that the courts will ultimately hold much of the recent state legislation to be unconstitutional. That is a question for the lawyers and the courts, on which Mr. Knapp's opinion is far more valuable than any that I might express. I base my argument against legislation of this character on the ground that it is economically unsound, and that, by injuring the railroads upon which the public must depend for transportation, it will inevitably react upon the people of the states in which it may be enacted.

If you will look into this matter thoughtfully I think you will agree with me that every business man should be an active, militant advocate of such public policies as will allow the strong and healthy growth of the railroad systems of the country, and that he should be an active opponent of everything passing the bounds of reasonable and proper regulation that would tend to retard such growth.

I cannot conceive that the people of any locality should deliberately favor a policy that would restrict investments, but business men will not put their money in any locality unless they are assured that its transportation agencies are strong enough and prosperous enough to expand their service with the growth of business. Since the construction of railroads first began they have ever been the forerunners of investments. In this day, in localities already supplied with railroads, further investments depend on the assurance of the adequacy of railroad facilities. For these reasons southern industrial development and southern railroad development must go hand in hand, in the future, as they have in the past. Stifle or restrict railroad development in any section, and the inevitable result will be to stifle or restrict all industrial progress and material advancement in that section.

I think that no one who studies the subject carefully and without prejudice can differ with me in the conclusions that the interests of a railroad and of the people depending upon it for transportation are identical, and that, while the public is entitled to the best service that the railroad can give, the railroad is equally entitled to just and fair treatment at the hands of the public. I think it must also be as clear to the business men of the South as it is to me that, if the railroads of this section are to increase their efficiency as transportation agencies and as allies with southern communities for southern development, they must spend large sums of money within the next few years. The practical question that confronts the railroad managers of the South is: How is this money to be obtained? This is not only a vital question for the railroads, but it is also a vital question for the southern people.

Notwithstanding the statements that are sometimes made to the contrary, but little of this money can be drawn from the earnings of the roads. The inadequacy of this source is shown by the fact that if the Southern Railway Company, from its organization, had expended for improvements every dollar of net income, after paying operating expenses, taxes and fixed charges, and had never paid a penny in dividends or carried a penny to surplus, the total to date would have amounted to only about $3,600 per mile estimated on its present mileage. How far short of requirements this would have fallen is shown by the fact that it has spent, or contracted to spend, for capitalized betterments and improvements in this period within a fraction of $14,000 per mile on its present mileage. With the rapid increase in operating expenses, due to higher prices and advancing wages, the proportion of net income to gross earnings becomes smaller and the utter inadequacy of income to supply funds for extensions and improvements is made much more manifest. By far the greater part of the money needed can be obtained only by borrowing. Ability to borrow depends on credit, and the credit of a railroad depends upon present and prospective income, just as the credit of any individual or of any business concern depends on ability to show that future income will be sufficient to meet interest charges and assure the security of the principal.

This being true, an attack upon the earning power and credit of a railroad, through legislation arbitrarily reducing its charges or imposing onerous and restrictive conditions on its operation, is an attack upon its ability to maintain its service and to extend and improve its facilities, and all such legislation must react upon the very persons it is intended to benefit.

But, it is said, if the railroads were not paying dividends on *excessive* capitalization, their credit would not be injured by legislation of this character and their surplus revenues would be sufficient to pay for betterments. This argument is based on the assumption that the capitalization of railroads as a whole is excessive, that the railroads of the country, taken as a whole, are greatly overcapitalized. An eminent authority on this subject is Chairman Knapp, of the Interstate Commerce Commission. On a previous occasion I have quoted his language as follows:

> "I regard the common talk about the overcapitalization of railroads as wholly ignorant and mistaken. I believe that, in far more instances than the people suppose, a fair valuation at this time would give figures far exceeding the present estimate."

Mr. Knapp knows, as does every practical railroad man, that capitalization cannot be predicated upon mileage. He knows that many other factors must be considered. He knows that upon every railroad system there are many miles of line that have cost many times the figure for average cost per mile on which these popular estimates have been based, and that the costs of yards, terminals and equipment must be duly considered and allowed for. It is a matter of common knowledge, especially to well-informed business men, that the cost of railroad terminals in all cities of considerable size is very large and greatly increases the average cost per mile of a railroad system. Equipment is another large item which depends upon volume of traffic more than on length of line and which adds very materially to the average cost per mile of every railroad system.

This whole question of capitalization, however, is one that interests security holders rather than the shipping public—the buyers of transportation. Capitalization does not affect rates. No one of the critics of railroad capitalization has ever suggested any practicable method of basing rates on capital. It cannot be done, and President Hadley, of Yale, one of the most profound students of transportation problems, was right when he said that railroad men "do not try to make their rates correspond to their capital." In practical experience it is found to be impossible. It is found that rates have to be so adjusted as to move commodities to competitive markets in competition with the products of rival producing localities, in competition with other carriers, and in competition with other similar products. The rates that will attract traffic and that will enable producers in the territory contiguous to a railroad to expand their markets and increase their production must be accepted, or the business will not move.

I think that every fair-minded man who will study the question thoroughly and dispassionately will agree with me as to the far-sighted wisdom of the legislature of Tennessee in declining to enact some of the legislation that was proposed during its session. Con-

*From an address by W. W. Finley, at Memphis, Tenn., Apr. 22.

sider, for a moment, propositions to reduce passenger fares on the railroads in the southern states. These are based on the ground that fares have been reduced in some other sections of the country. No account is taken of the radical differences of conditions affecting the passenger business of the railroads of the southern states and those with which comparison is made. Every farmer knows that there are some soils on which crops can be grown profitably even if the selling price is so low as to make their cultivation unprofitable on less fertile land. Exactly the same thing is true of railroad passenger traffic. It will undoubtedly be conceded that a railroad is justly and fairly entitled to reasonable compensation for the service that it performs. There are some sections of the country, where the population is dense and where a large percentage of the people live in large cities, affording regular and heavy suburban and interurban traffic, in which passengers can be carried at an average rate of fare per mile that would be ruinous to roads in less densely populated sections of the country. People who live in cities are ordinarily more actively engaged in business and travel more than people who are scattered through rural sections. The southern states, as a whole, are not fertile of passenger traffic for the railroads. It costs practically as much, or nearly so, to haul a passenger train with the cars empty as it does to haul it with every seat filled.

Any possible reduction in passenger fares would be of very little benefit to the average individual, but, in the aggregate, such reduction would seriously affect railroad income and cripple the efforts of the roads to increase and improve their passenger service. This is important to all the people of the South, for the reason that improved and safer passenger service and more comfortable and convenient passenger stations are far more important to this entire section than any possible reduction in passenger fares.

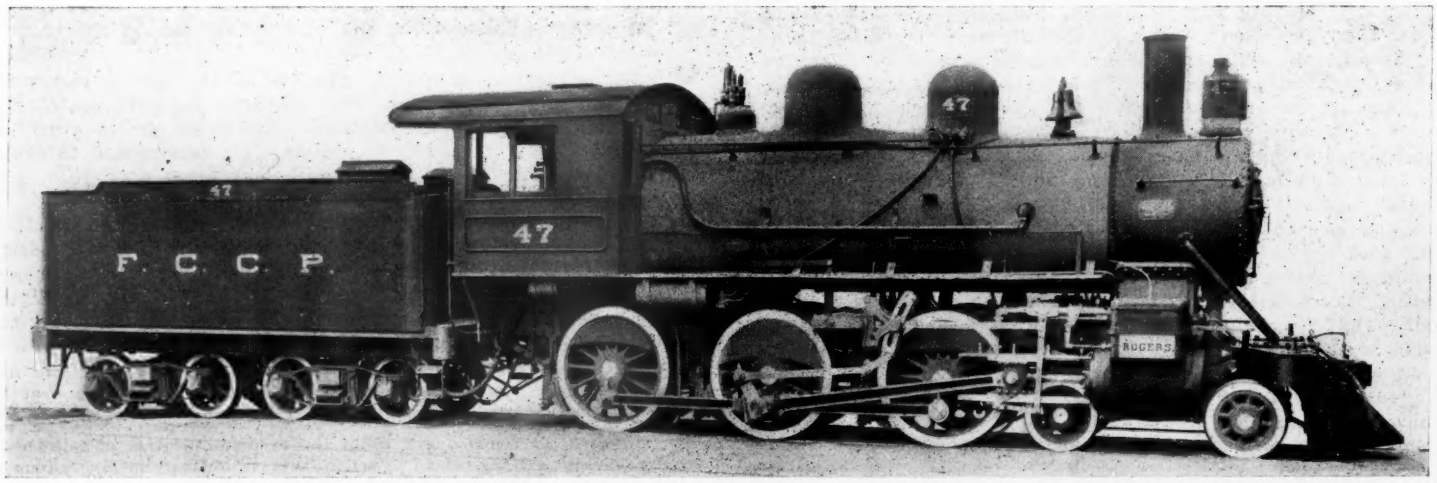
So-called "reciprocal demurrage laws" and all laws proposing to penalize railroads for failure to perform services in excess of their physical resources or to supply facilities in excess of their financial resources are also directly antagonistic to the interests of the public. The application of the designation "reciprocal demurrage" to a law imposing penalties on a railroad for failure to supply cars is misleading, for reciprocity implies equality of treatment, and there is absolutely nothing reciprocal in these laws. Demurrage is a charge, in the nature of rental, for the use by a shipper as a warehouse of property that does not belong to him and that is diverted from its true use as a vehicle as long as he holds it. A charge imposed on a railroad for failure to supply a car is a penalty, and can be properly imposed only when the road is able to supply the car and wilfully neglects to do so.

These laws are inimical to the best interests of the public because every penalty that is imposed under them lessens, to just that extent, the ability of the roads to increase their facilities and to perform the service required. They are also inimical to the interests of the great body of shippers and of the general public because, being operative only within the borders of the state in which they are enacted, their inevitable tendency is to bring about discriminations in favor of the comparatively few shippers whose business is confined entirely to that state and against the great majority of shippers whose business is not confined by state lines. They also operate to bring about discriminations in favor of the intrastate traffic in the state imposing the highest penalties. Laws requiring freight to move at a minimum rate of speed regardless of whether conditions are such as to make this movement impossible are injurious, both to the railroads and the people, on the same ground.

For these reasons I feel justified in urging upon you that your own interests demand from you something more than a mere passive belief on your part in the self-evident truth that the railroads should have fair play. The South needs, and needs urgently and speedily, a great expansion of transportation facilities. The railroads are willing and anxious to supply these facilities. As business men, therefore, you are vitally and personally interested in seeing that the railroads have fair play and a square deal; that their passenger and freight rates are not arbitrarily reduced so as to cripple their credit and prevent them from improving their facilities, and that they are not subjected to restrictive regulations as to car service and traffic movement that will make it impossible for them to give equal and fair treatment, to the extent of their ability, to all buyers of transportation, whether for interstate traffic or for intrastate traffic.

Ten-Wheel Locomotive for the Central Railway of Peru.

The American Locomotive Company has recently completed an order of 10 locomotives for the Southern and Central Railroads of Peru, intended for heavy mountain climbing in both freight and passenger service. The grades that these engines will be called upon to ascend are of 3 and 4 per cent., and reach to an altitude of 15,600 ft. In general design there is nothing to mark them as varying from the standards of American construction, but they have some interesting details that adapt them to the work that they have to do. The noticeable features seen in the accompanying cut are the presence of the operating mechanism for the Le Chatellier water brake and the method of valve stem connection to the combination lever of the Walschaert gear, by which it is arranged to operate a valve for outside admission. The inside admission with the piston valve having been so common as to be accepted almost as a standard practice, this use of the flat slide valve and outside admission seems almost like a variation of species. As in the case



Ten-Wheel Passenger and Freight Locomotive for Central Railway of Peru.

of other engines that have been illustrated heretofore, advantage is taken of the application of the Walschaert gear to secure a very substantial cross bracing of the frames, and the strong combination casting carrying the brackets for the lifting shaft and the link is used to good advantage. As will be seen from the illustration the link bracket is a separate casting with a deep, well-braced foot extending back on the cross brace. There are two waist sheets between the cylinders and the firebox; the forward one being bolted to the cross-brace at the guide yoke and back on to the brace just considered. This latter really extends down to take the two lower rails of the frames so that there is a rigid vertical connection at this point between all four members of the frame and the barrel of the boiler.

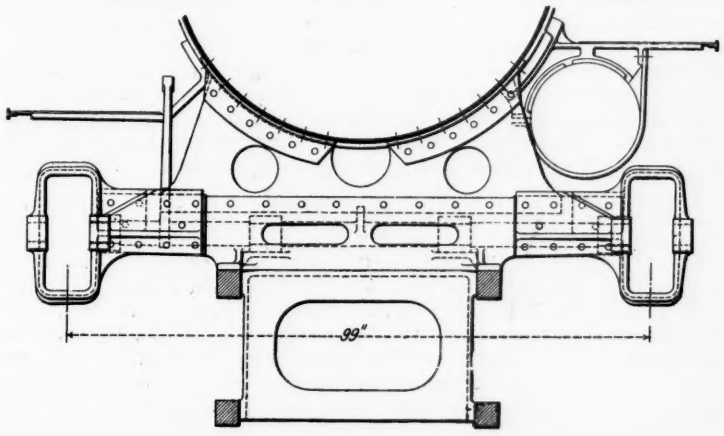
The method of fastening the eccentric crank to the crank-pin is that of using a split ring fitted on the crank, drawn together with a bolt and held in position by a key. The firebox is fitted for burning oil, but it does not vary from ordinary construction, except that the bottom is horizontal for its whole length instead of having the drop at the front in accordance with prevailing practice. The depth below the bottom of the shell to the bottom of the foundation ring is 18¼ in. and the tube-sheet is straight. The crown tapers back from front to rear and drops 2½ in. in the 102⅛ in. of the length of the firebox.

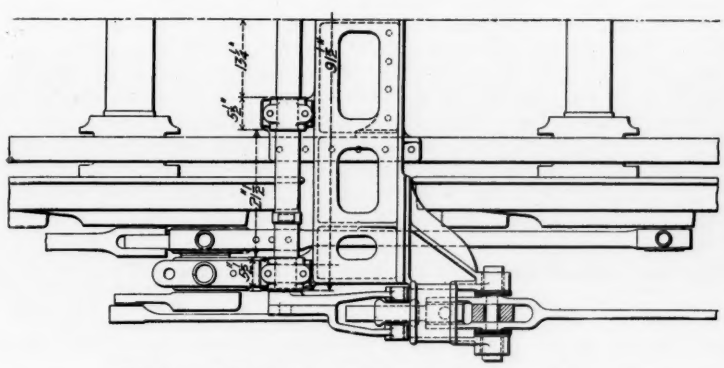
In addition to the Le Chatelier water brake, a further precaution for the service on the steep grades is the use of two 9½-in. Westinghouse air pumps.

The following are some of the principal dimensions of these engines:

Cylinder diameter	19 in.
Piston stroke	26 "
Wheels, diameter, driving	58 "
" " truck	30 "
" " tender	33 "
Wheel base, rigid	13 ft. 0 "
" engine	23 " 2 "
" engine and tender	47 " 5 "
Firebox length	102⅛ "

Firebox width	41¼ "
Tubes, number	272
" diameter	2 in.
" length	12 ft. 9 "
Heating surface, tubes.	1,804 sq. ft.
" " firebox	148 "
" " total	1,952 "
Tube heating surface equated to firebox heating surface (Vaughan's formula)	505.32 "
Total equated heating surface	653.32 "
Grate area	29.25 "
Steam pressure	200 lbs.
Fuel	Oil
Weight on drivers	104,000 lbs.
" on truck	37,600 "
" total	141,000 "
" engine and tender	232,000 "
Height of stack above rail	14 ft. 5 in.
Total length of engine and tender	56 " 3 "
Journals, driving	8½ in. x 11 "
Thickness crown, side and back sheets of firebox	⅜ "
Thickness, tube sheet	½ "
Type of oil burner	Von Boden-Ingles
Tank capacity, oil	2,000 gals.
Tank capacity, water	4,000 gals.
Tractive effort	27,500 lbs.





Plan and Elevation of Frame Cross Bracing.

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 3.8$$

$$\frac{\text{Weight on drivers}}{\text{Total weight}} = .74$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} = 5.13$$

$$\frac{\text{Tractive effort x diameter of drivers}}{\text{Heating surface}} = 817.0$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 66.9$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 0.082$$

$$\frac{\text{Weight on drivers}}{\text{Heating surface}} = 53.3$$

$$\frac{\text{Total weight}}{\text{Heating surface}} = 72.3$$

Volume of 2 cylinders = 8.52 cu. ft.

$$\frac{\text{Total heating surface}}{\text{Volume of 2 cylinders}} = 229.0$$

$$\frac{\text{Grate area}}{\text{Volume of 2 cylinders}} = 3.44$$

The impression that the railroad up Vesuvius was destroyed by the recent eruptions is partly correct and partly incorrect. There were, in fact, two connecting railroads. The one first built, and until comparatively recently the only one, began at the foot of the crater cove, and about 2,600 ft. above the sea, and was a cable road, ascending 13,000 ft. in a distance of 2,700 ft., nearly to the edge of the crater. This railroad was completely destroyed and the power house at the foot is now buried under 80 ft. of ashes, now mud. Whether any part of the plant under the ashes is fit for further use is not yet known. This cable road was formerly reached by an excellent carriage road, which was replaced a few years ago by a tramway partly worked by adhesion and partly by cog-wheels. This road was damaged comparatively little by the eruption, and most of it has already been restored, and passengers are carried to a point whence a climb of less than an hour by a practicable path brings them to the edge of the new crater. The railroads are the property of Thos. Cook & Son.

Signaling at the New England Railway Club.

The paper on railroad signaling read before the New England Railroad Club in March by Mr. W. H. Elliott, was printed in the *Railroad Gazette* of March 22, page 405. The discussion on this paper was participated in by Messrs. Morrison, Signal Engineer of the New York, New Haven & Hartford; Potter, locomotive engineman of the same road; Young, Signal Engineer of the Boston & Maine; Cheever, Superintendent on the same road; Droege, Superintendent on the New York, New Haven & Hartford; W. C. Smith, Signal Engineer of the Boston Elevated; Lindall, of the same road; F. E. Kinsman, of the Kinsman Block System Company, and R. H. Soule. Following is an abstract of the principal points brought out in the discussion:

Mr. Morrison—Referring to the distinctive color, I would suggest that one more color be added, and that is blue purple, for use in dwarf or slow-speed signals. Referring to track circuits in place of detector bars, I would not recommend the installation of track circuits in place of detector bars except where it was absolutely necessary—owing to the difficulty of shunting out the relays, especially if there is foreign current in the track, also on account of the expense of maintaining these track circuits. If any one of them fails it ties up the movement of the lever controlling the switches. I believe that flagging rule No. 99 could be changed to advantage where a proper system of automatic signals on double-track road is installed.

Regarding the locking of drawbridges, no expense should be spared. While we have all of our different rails on drawbridges locked, we formerly locked them together, but are making arrangements now to lock each rail independent. We will also lock the rails on our lift or jackknife bridges so that, should there be any derangement of the points, it would be impossible to give an approaching train a clear signal. As to automatic stops, I have examined a great many patent papers and models, and conversed with a number of parties claiming to have automatic stops, and have not as yet seen or heard of one that I would recommend be installed on a steam surface railroad.

Mr. Potter—You certainly want to get rid of the red light on the dwarf signal. I was just thinking of an instance. Superintendent W. L. Derr rode with me on the engine about a year ago. He was not familiar with this division. He was on the fireman's seat. When we swung round the curve at Roxbury, going about a 60-mile-an-hour gait, the signals at Chickering came in view. Well, for a guess you would have estimated the number of red dwarf signals at about 50, all in a bunch close to the ground—and all coming into view in a second. The high semaphores were all right. I saw Mr. Derr come off the seat, and I imagine every individual hair on his head stood on end. He said, "What is ahead of you?" I replied, "Nothing but what we are going through." Well, said he, "If we are going through anything wait till I get back to the hind end of the train. If I had anything to do with this division I would simplify those signals so d—d quick it would make your head swim." When we see those lights so near the ground, just about where a man would hold a red light to stop you, we have got to watch the light to see if it stands perfectly still. * * *

Mr. Cheever—I think that the present best type of automatic signal is about as safe as flagmen, and I am thoroughly in sympathy with the Railway Signal Association that flagmen need go back only far enough to see that the signal next behind them is at danger.

Mr. Young—Mr. President, after a flagman has gone back and stayed back the necessary length of time, and is called in by the engineer, and he puts his torpedoes down and goes in, you have got to wait that length of time before the train can start. Isn't it better for him to go back and see that the stop signal is up, and then return and be ready to start with his train at once, as soon as the train is ready to go? As for dwarf signals, the Boston & Maine has for 18 years put blue lights in on all new work.

Mr. Elliott—In reference to automatic stops there is a question as to how much the use of the stop will interfere with switching movements. Where safety is concerned nothing should deter us from securing that end, and as completely as possible; on the other hand, we are in the transportation business and must move trains, we must do it in as regular time as possible, we must make proper movements in order and securely, and if the stop is going to prevent us from making the proper movements we will not be

able to do our business. It is well that the matter is going to be threshed out by the commission, for I note that the law has been passed and the money will be available the first of July. Should it be found that the automatic stop does not interfere with switching movements, backing-up movements, double-heading trains or running trains in the reverse direction on a given track, there is little doubt but that the stop will come into use for certain classes of traffic.

Mr. Smith, of the Boston Elevated, answered a number of questions concerning the automatic stop in use on that road. He does not deem the system suitable for application on surface railroads.

Mr. Kinsman spoke of experiments now being carried out by his company on the New York Central. To provide for all possible demands his company proposes to provide an apparatus for making mechanical contact with a train above the surface of the rail. The effect of oscillation, due to irregularities of the track rails, especially where the frost is coming out of the ground, and also as a result of varying speed at which the train is run, is a serious matter. The Kinsman Company recommends the use of the sectional contact as against the continuous-current contact for the reason that under present practice definite points of control are demanded, and these points should be at or near the visual signal. A continuous contact for surface roads will result in the too frequent stoppage of trains at uncalled-for points along the line where the contact may be the least bit out of alinement or otherwise defective. It is not believed that steam railroad men are ready for that or to string trolley wires for this purpose. The Kinsman block system is so arranged as to detect any imperfection in the work of the visual signals and at the same time have any defect in the Kinsman system of wires or apparatus indicated by the action of the visual signal. In other words, each tends to check off the action of the other. This fact, together with the use of the recording device, constitutes an "unprejudiced surprise" checking system and a record of the condition of both every time a train passes a signaling point. It also establishes a disciplinary condition which tends to encourage the greatest care by engineers, inasmuch as a too frequent record of unexplainable automatic stops would be regarded with disfavor by the management; and at the same time it tends to protect a careful engineer from unfair criticism, as often follows in the case where conditions were entirely out of his control. This record also helps the Maintenance and Inspection Departments, by promptly reporting defects which might not otherwise be discovered in several days. It follows, therefore, that the four-part combination of a faithful engineer, a proper-working visual signal, a substantially constructed automatic stop and a permanent record of the integrity of the apparatus and operation of the train, can be depended upon to produce results which have been almost undreamed of heretofore.

For electrical roads we are installing a device by which the absence of the current in well-defined portions of the circuit will stop the car, and for steam roads we are now pushing the form which includes the guard rails placed at or just beyond the signal station or post for the purpose of protecting the engineer against those things which he cannot himself guard against.

Mr. Lindall told of an instance where the automatic stop saved a train on the Boston Elevated, in which the motorman had become unconscious while descending the steep grade from the elevated line at the North station down to the subway, south of that point. He believed that in this one instance the apparatus fully paid for all it had cost the Boston Elevated. Besides this there have been several derailments where the first notice that the motorman had of anything wrong was the application of the brakes by the automatic trip striking something. When the trips were first put on only ½ in. lap was allowed, but to provide for variations in trucks and for wear of rails the settling of springs and other inequalities, the trips were changed so as to allow for a lap of 1 in., and the trip now has a spring, so that when struck improperly by accident it will depress and not be broken. Since these changes no failures of trips have been known. No train in passenger service has passed a signal at danger without being tripped and no train has thus wrongfully passed a signal without the superintendent knowing it.

Mr. Soule, being invited to speak, gave a bit of history. He said: "I believe that I enjoy the distinction of having been the first signal engineer that was appointed in this country. It was absolutely without precedent to have such an officer on railroads, but in 1876, when the Pennsylvania Railroad was getting ready for the Centennial celebration at Philadelphia, it became necessary to take some action; and on the 4th of March of that year I was notified that I was to take up that work. There was a good deal of it to be done. The Centennial exhibition was to open on the 10th of June, and there was not much time to lose. So at noon on that very day, the 4th of March, I took the train to Philadelphia, and the next morning a party consisting of the General Manager, the Chief Engineer, the General Agent and myself, went over to New York and inspected the Toucey & Buchanan apparatus, which was in use on the New York Central. In that connection I wish to say that I think that Mr. Toucey, the General Superintendent, and Mr. Buchanan, the Superintendent of Motive Power of the New York Central, should have a great deal of credit for the work they did as pioneers in introducing systematic signaling into this country. The officials had a conference, and the New York Central tendered the use of its apparatus without royalty to the Pennsylvania. So I spent a week in New York picking up the threads and learning the apparatus, and at the end of that time one afternoon I got a couple of big express wagons and sent them to the old Thirtieth street shops of the New York Central road, and loaded them with patterns. I got them over to Jersey City and put them aboard a baggage car, and they were in Altoona the next morning. From those New York Central patterns there were built six interlocking apparatuses, which were installed near Philadelphia in preparation for the Centennial. Well, all railroad men came to the Centennial celebration, and I rather think that that was the first practical exhibition of interlocking and signaling on a large scale that the railroad men of this country had.

There was one interlocking apparatus in this country, however, at that time, but that had been built in London. That was a Saxby & Farmer, shipped over to this country and set up by English mechanics. That was installed at East Newark Junction on the Pennsylvania Railroad. But in 1877, the year after the Centennial, there were some changes made in the arrangement of the tracks over there, and it fell to my lot to rearrange that interlocking apparatus. The English patents were afterwards bought by the Union Switch & Signal Company, who also bought the Toucey & Buchanan patents.

Mr. Elliott—Referring to what has been said by Mr. Soule, the last Toucey-Buchanan interlocking machine was removed from service on the New York Central only last November. So well was the machine designed and built that it gave good service up to the time it was replaced by a larger machine of modern type. The time is coming when complete block signaling will be installed on many roads. We shall then be in the position that was so well stated by Mr. Joseph Crawford, of the Pennsylvania Railroad, when he said, "On important railroad lines detailed train rules and written train orders should be things of the past, and all movements of trains, not only when running on tracks designated for their use, but also when running on tracks assigned to trains running in the opposite direction, should be controlled and directed by signals, and the rear ends of trains when running slowly or stopped should be protected by fixed signals instead of by train flagmen." I trust we may soon reach this desired condition. (Applause.)

Mr. Young, replying to some questions about the automatic stop, thought that it would come in time, but that the first duty of railroads was to equip the whole of their lines with visual signals; that done it will then be time to put in adjuncts.

Track Deformations and Their Prevention.*†

BY G. CUENOT,
Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

IX.

STUDY OF WOOD USED FOR TIES.

Hard woods are principally used in France, oak or beech being preferred, but when these are not easily obtainable, or are too expensive, pine is used; but these woods are not utilized as they are found in commerce. They are first submitted to preservative processes, creosote generally being used. The timber, as purchased, is not that of the first quality used for framing—which costs in France 120 francs per cubic meter, say $55 per thousand feet b.m.—but second quality wood is used, especially second quality oak. The price of sap wood and wane oak, prior to the preservative process, is about $20 per thousand feet, while beech costs about $16 per thousand feet. Thus the untreated oak tie costs about 87⅛ cents and the untreated beech tie about 68 cents.

Beech makes an excellent wood for tie purposes, but is difficult to preserve and becomes worm eaten very rapidly if it is not allowed to dry under favorable conditions, especially if the bark is removed after the tree is cut down. Pine wood is quite resistant to compression but, owing to the loose texture of its fibers, it resists poorly the tearing caused by the fastenings and has a shorter life in service than the harder woods do unless the fastenings are made in a way which will be discussed further on.

Mr. Michel, Chief Engineer of the P. L. M. Company, has made a study of the relative compressibility of these species of wood to the limit of permanent deformation. According to him the resistance to compression of oak or beech, common pine, larch or spruce is as follows:

Species of wood.	Perpendicular to fibers.	Parallel with the fibers.	Proportion.
Oak or beech	3,413 lbs. per sq. in.	2,560 lbs. per sq. in.	.75
Common pine	2,845 " " "	2,133 " " "	.75
Larch or chestnut	1,707 " " "	1,138 " " "	.75
Spruce	1,138 " " "	683 " " "	.60

But this resistance to compression varies considerably according

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†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.

to whether the wood is treated or not, and also according to whether or not it is sustained between the walls of an envelope, as in the case of the composite tie. In the first case, with treated wood, the resistance to compression diminishes, as will subsequently be shown. In the second case, however, that of the composite tie, it increases very materially because the wood held fast between the walls of the metallic frame is sustained and the fibers have less play in relation with each other.

But before discussing these questions mention should be made of the process of treatment which is employed, since this has a considerable influence on the durability of the tie and consequently on its steadiness in the track. The experiments made have been carried on principally with beech, but the information derived can easily be extended to other kinds of wood. The quantity of creosote which can be used depends upon the amount of moisture in the wood which is being treated; therefore, the seasoning of the wood must first be considered.

In the first experiment, pieces of beech wood 9.84 ft. long, 6.3 ft. high and 6.3 ft. wide were cut immediately after the tree had been felled and were placed in rows on supports under shelter, to be seasoned. These pieces of wood, which contained on an average 45 per cent. of their weight of water in the beginning, were weighed separately, at first every 15 days and then at longer intervals. The successive losses of moisture are given in the following table:

Periods of weighings. 1896.	Duration of seasoning.	Successive proportions of moisture remaining in the wood at each weighing. Ordinates.	Character of wood, according to the degree of seasoning.
1st May.	Beginning.	44.6 per cent.	From 45 to 40 per cent. of moisture some days after felling, the water flows from the wood and forms pools at the foot of the pieces when they are on end.
15th May.		38.0 "	
1st June.	1 month.	31.6 "	From 40 to 35 per cent. of the wood still surcharged with water appears translucent at the surface, when it has just been cut; the fresh shavings are semi-transparent when interposing them between the eye and the light.
15th June.		28.6 "	
1st July.	2 months.	26.5 "	
15th July.		24.5 "	
1st Aug.	3 "	23.0 "	Below 30 per cent. moisture, it is difficult at first sight to state the degree of seasoning.
15th Aug.		22.5 "	
1st Sept.	4 "	22.0 "	With 20 per cent. of moisture, it can be said with certainty that the wood has arrived at its maximum practical seasoning without stove-drying, because it will scarcely dry more when exposed to the air another year.
15th Sept.		21.8 "	
1st Oct.	5 "	21.7 "	
15th Oct.		21.6 "	
1st Nov.	6 "	....	It is probable that the ties in the middle of a pile could not attain this degree of seasoning.
1st Dec.	7 "	....	
1897. 1st Jan.	8 "	....	The wood after 5 to 6 years of seasoning under shelter, still contains 10 to 12 per cent of moisture.
1st Feb.	9 "	21.8 per cent.	

This wood was clearly not piled under conditions, as regards seasoning, identical with those of ties piled in the ordinary manner, since these are exposed to the weather and would presumably be slower in drying, but the extreme limits of seasoning remain the same; that is, the maximum of moisture at the beginning will be 45 per cent., and at the end it will be about 21 per cent. These limits are sufficiently accurate for the discussion which follows:

It will be seen by the above table that nearly the maximum seasoning was obtained in 4½ months after felling, from the first of May to the 15th of September, during the fine season. From the 15th of September to the 15th of February following the percentage of moisture of the wood remained stationary around 22 per cent., with slight fluctuations; then, during the fine season following, up to October, 1897, the rate of moisture descended to 20 per cent.

According to previous statements, beech wood, after six years of seasoning under shelter, still contained from 10 to 12 per cent. of moisture; but from the point of view of practical drying of ties, it is scarcely possible, without stove drying, to lower it below 22 per cent. of moisture.

The quantity of water contained in pine is at least equal, if not greater than, that which is found in beech, that is to say about 45 per cent. immediately after felling and 20 per cent. after seasoning. It is not the same in the case of oak; the percentage of moisture which it possesses is certainly less, the fibers of the wood are more compressed, and the quantity of water which they enclose more restricted. It is difficult for me, for want of precise experiments, to give an exact figure; it can be said, however, that this wood dries very slowly, keeps its moisture a very long time, and absorbs, consequently, a very small quantity of creosote. On this account, it is difficult to say when the preservation process can best be undertaken. This refers to the heart of the wood, not to the sap, which loses its water very rapidly.

When cross sections of new beech cross ties creosoted with 35 lbs. and containing much moisture (30 per cent. for example, which is very common), are immediately examined after the injection has been made, it is noticed that the creosote has penetrated into the end by the annual layers of the autumn wood, and that the spring wood, though considered more porous, has not been absolutely impregnated; the wood resembles a series of concentric rings alternately creosoted or intact.

The sections, made quite near the extremities, show the wood impregnated for a certain distance without alternations; at 3.94 in. the rings commence to be defined, 7.87 in. they are very clear, and occupy nearly the whole section of the wood. (Fig. 24.)

But proceeding towards the mortises for plates, the notable portions of these rings disappear (Fig. 25) and become more rare in proportion as they approach the middle of the length, where, often, there is no longer any trace. (Fig. 26.)

On the other hand, it is seen that the creosote has also penetrated through the lateral surface, by reason of the degree of moisture in the wood; above 35 per cent. there is almost no more penetration, scarcely two to three millimeters (0.08 or 0.12 in.), sometimes none; towards 30 per cent. the creosote has penetrated to a depth of two to three millimeters (0.08 to 0.12 in.), for the color of the wood goes on getting weaker in the direction of the depth.

In the moist wood, as above, there exist few cracks arising from seasoning; when they are observed they are in the direction of medullary rays, not penetrating to more than two to three centimeters (0.79 to 1.18 in.), and the creosote has penetrated a little deeper by them. These cracks do not follow the meshes, but form freely among them.

If a transverse cut is made at the extremity of a beech tie injected with 35 lbs., freshly creosoted in the moist state (30 per cent. for example), it is observed that the concentric rings of the annual layers form alternations of wood creosoted and not creosoted; but by leaving the piece of wood of small sectional volume in the air, the rings of creosote, clearly limited and defined on the cut surface,

Fig. 24.

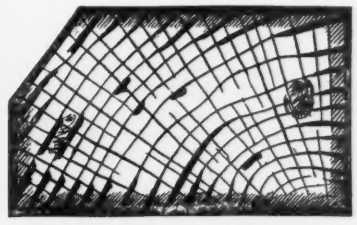

Fig. 25.

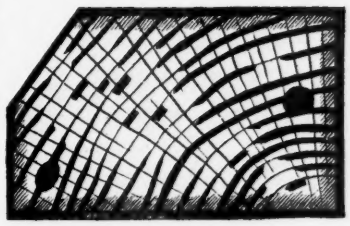

Fig. 26.

spread out by the seasoning and the creosote is diffused in the circular intervals of wood previously intact. When this piece of wood has finished drying (which requires one or several days, according to the thickness of the piece and the temperature), the creosote is diffused in a diluted greenish tint, which sometimes occupies the whole mass. In the sections of these moist ties made towards the mortises for plates, or towards the middle of the tie, are parts the least injected, where, at the moment of making the section, only small portions of wood creosoted are seen, the diffusion on drying is exceedingly slight.

But if these samples of wood imperfectly creosoted are preserved in moist sand, no diffusion apparently takes place. According to that it would seem that there was advantage, for the diffusion of the creosote, in keeping the ties after creosoting exposed for a long time to the air, but it is observed that this diffusion, which is well done, and within a short time, with the small samples, is much slower with the ties exposed to the air.

On the other hand, the tie from which the piece in question has been cut, is preserved even in the air with its tints in rings, without any diffusion, during several months, and to such a degree that it keeps at least 30 per cent. of its original moisture; once placed and buried in the ballast, it losses or absorbs moisture very slowly, according as it is more moist or more dry than the medium surrounding it when it is first placed in the track. When it has reached the degree of moisture of the ballast, the latter diminishes or increases according to the seasons. In ties weakly creosoted with 35 lbs. in pure gravel ballast, in position for at least five years, the wood not injected, in the interior of the tie, contained from 30 to 35 per cent. of moisture in the month of September, after a month of dryness and an ordinary summer; in a ballast of broken stone this proportion of moisture is much less, from 20 to 25 per cent., which favors diffusion.

In these kinds of ties the impregnation is generally produced by the rings of autumn wood; it was not diffused, and the rings, although compared, remained in their primitive state. The limiting amount of moisture at which the diffusion commences to work is not known, but it is evidently less than 30 per cent.

When the amount of creosoting is reduced from 46 to 35 lbs.,

beech ties are imperfectly creosoted, and the white wood* not creosoted appears on the mortise for the plate, that is to say, at a distance of a centimeter (0.39 in.) from the surface. With the aid of a special auger, numerous samples of untreated wood were taken from these ties, and from 30 to 35 per cent. of water was found. When they have 30 per cent. moisture they are only superficially creosoted, except at the extremities over 9.84 in. long, where the injection has penetrated without reaching the mortises for plates. Some ties of this nature employed in the annual track renewals from 1889 were submitted to a special examination. By sounding them from time to time it was proved that they were rapidly worm-eaten, and that at the end of four years a large number of them, from 15 to 30 per cent., according to their position in the track, commenced to decay in their interior; 10 per cent. were already replaced at the end of this short lapse of time.

(To be continued.)

Effects of Steaming and Preserving on the Strength of Ties.†

The effect of steaming upon the strength of the wood depends upon its pressure and duration. The action of either one of these depends upon the kind of wood. A light, open structure, or sapwood, suffers more than a close-grained wood, or heartwood. Seasoned timber suffers more severely than green wood.

Formerly it was thought that the heat of the steam would evaporate the moisture and sap in the cells. It is doubtful if the temperature rises high enough in the tie under ordinary conditions of steaming to effect this evaporation. There is, however, a leaching effect and also a heating of the air in the cells whereby the sap is driven out. Mr. Octave Chanute and Mr. C. G. Crawford have recently dealt with these matters in addresses before the Memphis meeting of the Wood Preservers' Association.

When steam is applied to the wood and is condensed the fiber takes up more water than that found in green timber. In other words, the fiber-saturation point described above is raised, and just as green timber is weaker than dry timber, so in the same way steamed timber is weaker than green timber. In the case of small pieces, within undetermined limits of steaming, which depend on the condition and kind of wood, the strength may be regained when the wood is redried to its original moisture content. There is, however, a permanent change of structure, for upon resoaking wood that has been steamed and dried the increased fiber-saturation point and weakness again prevails. The steam pressure may be high enough or prolonged so unduly as to scorch the wood, depending upon the quality of the wood and its condition of seasoning. It seems from the generality of evidence in circular 39 that a steaming for four hours at 30 lbs. pressure, or for six hours at 20 lbs. pressure, was nearly the limits of safe treatment. Mr. Chanute recommends in the case of fresh cut wood 30 lbs. to begin with, and 20 lbs. toward the close of the operation.

It is generally admitted that creosote enters only the openings of the cells and does not penetrate or impregnate the cell walls themselves, and for this reason creosote of itself probably has no effect on the strength of the cell walls. It only acts to retard the seasoning process, and thus creosoted timber will have the strength of green timber if there has been no steaming process, or will have the strength of steamed timber. Indeed in the Rueping process it is possible that the wood becomes seasoned in the cylinder, and thus with a light absorption of oil the timber may be stronger after the process than before. This is not a unique result of the process, but might be accomplished by some other non-steaming process, such as "boiling."

Circular 39 gives in a very complete manner the details of the tests on small pieces of timber tested at St. Louis. It also contains the results of tests upon full-sized loblolly pine ties that had been steamed and subjected to treatment with zinc chloride or with creosote. This table is reproduced in the tables. These full-sized ties had been seasoned for about one year after treatment, and the net result of the steaming was to diminish the strength of these ties under the various kinds of tests applied thereto. The creosoted ties represent an abnormal impregnation of 28 lbs. of creosote per cubic foot. The modulus of rupture of this timber, which had been steamed at 20 lbs. for four hours, and then treated with 28 lbs. of creosote per cubic foot, and then seasoned for eight months, was 69½ per cent. of the strength of the original seasoned ties. This, in the writer's opinion, shows mainly the effect of the creosote in preventing the natural increase of strength due to the seasoning of the tie. It has been stated above that no substantial increase of strength can be expected when large timbers are seasoned, but railroad ties are not included within this observation.

After having recorded the above observations and relations, the writer concludes that the fiber stresses to be used in the design of trestles constructed of creosoted timber can only be determined with some degree of certainty after a series of tests shall have been conducted on large timbers of bridge material that have been treated by the improved processes prevailing at present.

Specimens, Full-Sized Loblolly Pine Ties, Seasoned, Treated, and Re seasoned Before Tests.

Treatment.	Cylinder conditions—steaming—Period, hrs.	Pressure, per sq.in.	Temperature, Deg. F.	Strength (static). Bending. Modulus of rupture, per cent.	Compression—Parallel to grain, per cent.	Compression—At right angles to grain. per cent.	Average of the 3 strengths, per cent.	Spike pulling—force required to pull spike.—Screw, per cent.	Spike pulling—force required to pull spike.—Common, per cent.	Rings, per inch.	Weight, air-seasoned, lbs., per cu.ft.
Steam at various pressures	4	10 lbs.	237	99.2	79.3	91.1	89.9	118.5	110.7	4.9	38.0
	4	20 "	258	93.7	78.4	99.1	90.4	103.6	109.4	5.2	37.3
	4	30 "	274	87.8	83.4	92.7	88.0	100.1	96.5	5.3	37.9
	4	40 "	286	88.4	78.1	74.6	80.4	93.0	77.9	5.2	37.8
	4	50 "	295	69.1	60.6	74.4	68.0	80.4	70.3	4.8	36.1
Steam, for various periods.	2	20 "	257	82.4	81.9	87.1	83.8	97.9	93.7	5.1	38.1
	4	20 "	258	93.7	78.4	99.1	90.4	103.6	109.4	5.2	37.3
	6	20 "	256	87.5	78.8	92.0	86.1	83.0	79.0	4.8	36.7
	10	20 "	256	77.0	75.5	73.2	75.2	84.1	76.8	4.9	36.7
Zinc chloride, 2.5 per cent. solution.	4	20 "	258	74.7	65.1	68.6	69.5	75.3	73.8	4.3	41.5
Creosote, 28 lbs. per cu. ft.	4	20 "	257	69.5	61.2	60.1	63.6	68.2	68.1	4.6	65.3

Untreated wood = 100 per cent.

Physical Characteristics and Average Strengths of the Untreated Wood.

Moisture, per cent. (approximate)	20.0
Weight per cu. ft. (air-seasoned), lbs.	38.4
Rings, per inch.	5
Modulus of elasticity, lbs. per sq. in.	1,568,000
Bending strength at elastic limit, lbs. per sq. in.	3,429
Bending strength at rupture, lbs. per sq. in.	6,458
Compression strength parallel to grain, lbs. per sq. in.	4,452
Compression strength, right angles to grain (rail bear'g), lbs. pr sq.in.	503
Spike pulling—common spike, lbs. per sq. in.	3,598
Spike pulling—screw-spike, lbs. per sq. in.	7,748

Amount of Water and Preservatives Absorbed by Full-Sized Seasoned Loblolly Pine Ties During the Cylinder Treatment.

Treatment.	Cylinder conditions.*—Period, hrs.	Pressure, per sq. in.	No. of ties.	Weight, full-sized ties.†—Before steaming.	After steaming.	After treatment
Steam, various press.	4	10 lbs.	16	132.1 lbs.	137.2 lbs.	.....
	4	20 "	16	129.5 "	136.4 "	.....
	4	30 "	16	136.6 "	142.9 "	.....
	4	40 "	16	140.8 "	148.9 "	.....
	4	50 "	15	134.8 "	139.1 "	.....
Steam, various periods	2	20 "	16	136.6 "	145.9 "	.....
	6	20 "	15	128.7 "	139.5 "	.....
	10	20 "	16	128.1 "	138.8 "	.....
Creosote, 28 lbs. pr cu.ft.	4	20 "	15	135.7 "	140.0 "	237.2 lbs.
Zinc chloride.‡	4	20 "	15	141.6 "	146.2 "	247.2 "

*Steaming.
†Nominal cross-section 6.75 in. to 9.25 in.
‡2.5 per cent. solution.

*The wood which remains with its natural color, without any trace of injection, is called white wood in beech; the most common color of beech is clear yellow; it is often white as poplar; exceptionally, it is reddish. The heart wood, which appears towards the age of 30 to 35 years, is red, very hard and appears to be proof against the injection of an amount of 33 lbs. Untreated heart wood is not found in the cross ties of 1877, subjected to 55 lbs. of creosote. All the wood in these old ties is strongly impregnated with creosote. The whole of the wood is strongly impregnated with creosote.

†From the report of Prof. W. K. Hatt to the American Railway Engineering and Maintenance of Way Association.

Russian Petroleum.

The production of petroleum in Russia, which because of the riots at the Baku wells fell off nearly one-third from 1904 to 1905, increased in 1906, but only by a small amount, order not yet having been completely restored, and the immense damage by burning in 1905 not nearly made good. In millions of gallons the production has been for three years:

1904.....3,058 1905.....2,052 1906.....2,225

This reduced production has been a very great misfortune to Russia, because petroleum forms a much larger part of its full supply for industrial purposes than in any other country, nearly one-third of its locomotives using it and most of the river steamboats. The producers of petroleum, however, seem not to have suffered at all—quite the contrary—the value of the petroleum produced having been approximately, in millions of dollars:

1902....27.2 1903....47.2 1904....44.9 1905....40.9 1906..56.9

Thus the production last year, while 23 per cent. less in quantity than in 1904, sold for 27 per cent. more money, the average price having risen from .62 to $1.07 per barrel. The Russian petroleum is heavy oil, yielding a comparatively small percentage of illuminating oil, so that a much larger proportion than of our oil is useful only as fuel. The effect on the national industries of an increase of more than 70 per cent. in the cost of fuel may be imagined.

GENERAL NEWS SECTION

NOTES.

Both houses of the Illinois legislature have passed two-cent fare bills, and will undoubtedly agree on a law.

The Chicago & Eastern Illinois is considering plans to carry Illinois coal to New Orleans by boat from Joppa, its terminus on the Ohio river.

The railroads of Kansas put on sale on the first of May 500-mile and 2,000-mile books of tickets at two cents a mile, conforming to the law passed by the last legislature.

The Department of Agriculture last week handed to the Department of Justice evidence concerning 468 offenses against the 28-hour law regulating the transportation of live stock. About 900 other cases are under investigation.

The New York, New Haven & Hartford has made increases in the pay of conductors, trainmen and telegraph operators, but no definite information is given out concerning the amount of the increases. The Union Pacific and Southern Pacific have increased the pay of clerks and stenographers.

The Interstate Commerce Commission, in response to an inquiry from the Toledo, St. Louis & Western, has decided that the practice of allowing a percentage on tickets sold by Sunday-schools, labor unions, etc., for excursions they arrange, is illegal. Special rates may be made, of course, but the railroads must do the soliciting and advertising, and receive full cash fares.

The Canadian Pacific announces that this summer, in addition to the two regular daily through trains, and the special transcontinental limited train, there will be one additional fast passenger train across the continent three times a week, running through in about 85 hours. The Canadian Pacific will also run an express train between St. Paul and Spokane, using the new Spokane & International.

The Circuit Court at Bellefontaine, Ohio, May 1, in the case of Miller against the Toledo & Ohio Central, decided that the collection of 10 cents additional from a passenger who pays fare on a train is unlawful under the present Ohio two-cent statute, notwithstanding a provision for refunding the 10-cent excess. The court holds that, to come within the law, the rate, including the excess, must not be over two cents a mile.

The Federal Grand Jury at New York City has found indictments against the Rock Island on twelve counts; the New York, Ontario & Western on thirty counts; the Chicago, Milwaukee & St. Paul on thirteen counts, and the Western Transit Company on twelve counts, for making illegal rates. It is said that rebates to the American Sugar Refining Company, commonly called the Sugar Trust, constitute the principal offenses.

The Pennsylvania Railroad announces that the first examination of applicants for the Frank Thomson Scholarships will be held in June, at New York. The college entrance examination board of New York City has been selected to conduct the examination. Applications are to be sent before J ne 3 to Thomas S. Fiske, secretary, sub-station No. 84, New York City. The examinations are open to all sons of Pennsylvania Railroad employees.

The advance of 5 cents a ton in soft coal to the Atlantic seaboard, which was announced a month ago, went into effect on May 1. It is estimated that the five principal roads carrying this traffic will, by this change, increase their revenue about $5,000,000 a year. On the same day advances, averaging one-half cent a bushel, were made in the rates on grain from Lake Erie to New York and other seaboard points. The principal roads have also made advances of 10 per cent. in the rates on iron and steel.

The Interstate Commerce Commission, in an opinion by Chairman Knapp, has ordered the Delaware, Lackawanna & Western to resume the delivery of oil in tank cars at its freight station at Clymer street, Brooklyn, N. Y. The company discontinued delivery of oil at that place last October. The commission says that by this action the road will put the complainants out of business in Brooklyn, or else compel them to go to the Standard Oil Company to get their supplies of oil. In either case the action of the road will inure to the benefit of the Standard. An officer of the railroad said to a reporter that the delivery of tank cars at the station named was stopped because a number of small fires had broken out there last year, oil being frequently spilled when the cars were being unloaded.

The roads west of Chicago have agreed to a considerable lengthening of time of through passenger trains after all. Beginning June 9 the minimum time between Chicago and the Missouri river is to be 20 hours, or 3 hours and 30 minutes longer than that of the fastest train now running. The time between Chicago and Denver will be lengthened from 27½ hours to 32 hours; and between Chicago and the Pacific coast from 71¼ hours to 72 hours. The eastbound time from the Pacific coast will be the same as the westbound.

Without laying down a general rule as to what constitutes "doing business" within a judicial district, such as would give the court jurisdiction over a suit, the Supreme Court of the United States has held, in an action brought against the Chicago, Burlington & Quincy, that service on its division freight and passenger agent at Philadelphia was not sufficient for the maintenance of the suit. It affirmed the dismissal of the suit, which was brought by Robert M. Green to recover damages for personal injuries received in an accident on the Burlington road in Colorado.

Following the decision of the Interstate Commerce Commission that party tickets must be open to all persons alike, the railroads south of the Potomac and Ohio rivers and east of the Mississippi have announced that all reduced rates for parties will, on June 1, be withdrawn. Theatrical and such like parties will thenceforth have to pay regular fares. At Chicago it is reported that the Western Passenger Association has decided to ignore the rule. The Santa Fe led the opposition to the ruling, declaring that not until the courts ordered it to do so would it open its party rates to the public.

On the carriages and cabs run by the Pennsylvania Railroad in New York City, carrying passengers to and from the Twenty-third street station of that road, the fares have been raised. A hansom carrying one or two persons for 1½ miles or less now costs 50 cents instead of 25 cents as formerly; four-wheel carriages now cost 50 cents instead of 40, and for additional miles, for either kind of carriage, the charge is now 25 cents instead of 15. The former rates are said by an officer of the company to have been so low that the business was done at a loss; and the present rates are less than those charged by public cab drivers.

It is announced that the traffic and operating departments of the Union and the Southern Pacific are to make strenuous efforts to prevent a recurrence of the coal famine next winter by trying to induce coal dealers to lay in their winter's supply in the summer months. A personal canvass is being made in all the cities, and coal dealers are being urged personally to co-operate with the railroads. "It is the purpose of the railroads to either get the west and northwest adequately coaled during the warm months or to place the blame for any future famine where they say it rightfully belongs—with the dealers who wait until the last moment to get their winter's supply." So much for moral suasion. From the Indian Territory it is announced that the Missouri, Kansas & Texas, evidently believing that "money talks," will issue special rates of 25 cents a ton off the regular rate on lump, egg and mine run coal, effective June 15 and expiring August 15, from all mines in the Indian Territory and Arkansas; this to encourage dealers and the public generally to put in a reserve supply in the summer.

Notes on Cuban Railroads.

There is a curious old railroad here at Camaguey, Cuba, the oldest in America outside of the United States, and the first ever built within the dominion of the King of Spain. It is 53 miles long, the track has a broad gage of 5 ft., and it runs from the port of Nuevitas on the north coast of Cuba to this venerable town of Camaguey. It was built in 1837 to accommodate eight large sugar mills owned by eight of the ancient families of the region. Nuevitas was then an important port and the shipping place of a great deal of sugar, which was hauled from the plantations in ox carts. Each planter had his own road until the eight neighbors got together one day and for the sake of economy decided to combine and build a broad, smooth highway to the sea, with cut-offs to the different plantations. One of the planters who had recently visited Baltimore

and seen the railroad which John W. Garrett built from Baltimore to Ellicott's Mills a few years previous, suggested that a railroad would be better than a cart road. He explained to his neighbors the advantages of rolling wheels over smooth iron rails instead of on the bare ground, and demonstrated the economy of using a steam engine instead of oxen as motive power.

The road was finished in 1838. It cost about $1,000,000, and the capital stock was divided into eight shares of $125,000 each, which were taken by the heads of the eight aristocratic families who entered the scheme at the start. During the 70 years that have elapsed, control of the Nuevitas-Camaguey Railway has remained in the hands of the original owners. The eight shares have been subdivided among their descendants until there are now about 200 stockholders, called "couponistas." Frequent attempts have been made to buy up the road, but the owners of the shares would just as soon part with their lives. The property pays big dividends. The lowest on record was 12 per cent. and the highest 40 per cent. a year. Dividends are declared every 30 days. At the end of every month the treasurer collects all the money due, pays all the bills, strikes a balance, and then goes around from house to house with a tin box under his arm and gives each "couponista" his or her share of the profits. He is accompanied by a private secretary whose duty is to furnish a financial statement to each person interested and take charge of the receipt. This duty was performed by the same treasurer for more than 40 years, and his visits to the houses of the shareholders were as regular as those of the milkman. The men shareholders take turns as officers and directors of the road. The only permanent officials are the Superintendent, who is the technical man, and the Treasurer. A new President and a new Board of Directors are elected during the first week of every January and they serve in turn without compensation.

During the sugar season there are two trains a day in each direction, mixed freight and passenger cars. During the rest of the year there is only one train each way. The fare is $2 for the 53 miles, and has always been the same. There has been no change in the passenger rates since 1838, although freight rates have frequently been raised or lowered according to circumstances. The company now owns 11 locomotives, 10 passenger cars, 67 box cars, 22 cattle cars, 28 flat cars and 12 cabooses. The locomotives were bought in the United States, but the cars were all built in the company's shops, and some of them have been running continuously since 1850. The connecting railroad has endeavored to persuade the company to change the gage from 5 ft. to standard, so that cargoes can be sent through to Nuevitas without changing cars. But the directors are afraid that the other road will get the better of them in some way or other unless they act independently. Therefore they will not change the gage or accept through bills of lading. Portions of the roadbed have not been disturbed for more than 30 years. Trains are still running over rails that were laid in the '60s. The ties are all of jique wood.

Jique (pronounced hickey), acana, jucaro negro, all hard woods which do not grow large and cannot be used for cabinet work, are just as good as mahogany for ties and will outlast steel rails in this climate because they won't rust. On the Nuevitas-Camaguey line are jique ties that have been in use for 50 years. Some of them have been taken out and used for fence posts after 30 years in the roadbed. There is a tramway at Camaguey with rails of jique wood over which the cars have been running for more than a quarter of a century, and they do not show wear any more than steel after the same service. Much of the wood is so hard and heavy that it will sink in water.

Mahogany is often used for ties by the railroads in Cuba as well as in other tropical countries, but Sir William Van Horne has forbidden it on his road. He considers it a crime to cut small mahogany trees, as there is plenty of other timber in the forests suitable for construction purposes. A bridge on the Cuba Railroad near Santiago is built entirely of mahogany, but in violation of orders. The contractor did not know, or claimed not to know, that the caoba tree, as it is called in Spanish, was the mahogany which Sir William had tabooed, and the latter did not learn that he had a mahogany bridge on the line until it had been in use for several months.

The track on the Cuba Railroad is inclosed with wire fences on either side the entire distance to keep cattle from interfering with the trains, and many of the fence posts have blossomed like the rod of Aaron and are bearing flowers and fruit. The soil is so fertile and vegetable life so vigorous that any stick which retains the sap of the parent tree in its fiber will take root wherever it is placed in the ground. When these fences were built the posts were cut in the adjoining forests, and those that were green have survived and are now flowering trees. Surveyor's stakes have been known to take root and grow. Another curious freak of nature is orchids growing on telegraph wires. The atmosphere, like the soil, is full of fertility, and slips of air plants which have become detached from the trees and have lodged across the wires are now growing as bravely as any parasite you ever saw. The trees are draped with orchids.—William E. Curtis in special correspondence of the *Chicago Record-Herald.*

Agreements Canceled Between Harriman Lines and Salt Lake Route.

R. S. Lovett, General Counsel of the Southern Pacific Company, has informed the Interstate Commerce Commission that a traffic agreement between the Southern Pacific Company and the San Pedro, Los Angeles & Salt Lake Railroad, which was made public by the Interstate Commerce Commission hearings at Los Angeles some months ago, was abrogated and canceled on April 15, 1907, because of the enactment by the California legislature of a law to prohibit contracts in restraint of competition.

This traffic agreement, which was to run for 99 years, was put in force June 18, 1903. Its two most important provisions were as follows:

ARTICLE 2.—In partial consideration of said covenants and agreements of the said Southern Pacific company, said San Pedro company hereby covenants and agrees with said Southern Pacific company that it will, upon the execution of this agreement, adopt, print, publish, and put in force at all points on its leased, owned or operated railroad for the handling of local business thereon, the lawful freight rates, tariffs, classifications and charges used by the said Southern Pacific company, for the hauling of any local business which may be the subject of competition between them.

ARTICLE 3.—Each party hereto mutually covenants and agrees to and with the other that after the adoption and putting in force of rates as provided by Art. 2 neither of them shall or will change any such rates without the consent of the other party thereto, unless such change shall be necessary in order to meet the rates, charges, classifications or tariffs of any competing company or competing line of railroad or to conform to the final decree or judgment of some court of competent jurisdiction, or some lawful or valid requirement of state or national law.

Another contract which was to have run for 99 years and which is reported also to have been canceled on April 15, was between the Oregon Short Line (Union Pacific) and the San Pedro company. This contains the following provision:

ARTICLE 1.—Said San Pedro company hereby covenants and agrees to and with said Short Line company that it will not hereafter during the term of its agreement extend its main line of railroad or any of its branch lines, nor construct or build any lines of railroad, nor assist or advise in the building or construction of any other railroad northward from Salt Lake City, nor which may run into the territory northward of the parallel of Salt Lake City, Utah.

Train Robbers Near Butte.

The eastbound through express train of the Northern Pacific was stopped by masked men 18 miles east of Butte, Mont., on the morning of May 7, about 2 o'clock, and the engineman, James Clow, was shot and killed, the fireman at the same time being wounded. The robbers ran away without trying to enter the cars. A sheriff was on the train and, with one of the trainmen, pursued the bandits, but without success. A satchel full of giant powder was left on the tender. Engineman Clow was on a train attacked by robbers in February, 1903, not far from Butte.

Award of Cotton Manufacturers' Medal.

At the annual meeting of the National Association of Cotton Manufacturers, held on April 24 at the Massachusetts Institute of Technology, the association medal was presented to Charles B. Burleigh in acknowledgment of the merits of a paper on "The Curtis Vertical Steam Turbine," read before the association at its fall meeting Sept. 13, 1906. This medal was established at the annual meeting of the association in 1899. It may be given to any person whose work has been, in the opinion of the governing board, an advantage of sufficient importance to the purposes to which the organization is devoted.

Another A. C. Trolley Line Opened.

The first section of the alternating-current part of the Illinois Traction system was opened between Peoria and Bloomington, April 21. On that date a regular time-table was put into operation, cars leaving the terminal stations on the odd hour throughout the day from 5 a.m. to 11 p.m. Beyond the usual delays incident to warming up new equipment, the single-phase motors and auxiliary apparatus are said to have worked well. This road is one of the four single-phase lines in the Middle West which have adopted single-phase alternating-current apparatus made by the General Electric Company.

TRADE CATALOGUES.

Wheel-Truing Brake-Shoes.—The Wheel-Truing Brake-Shoe Co., Detroit, Mich., is mailing to the trade a card showing a half-tone view of a large shipment of its shoes made recently. There is also a brief statement of their advantages and the saving effected by the use of these shoes.

Manufacturing and Business.

The New York offices of Robert W. Hunt & Co. have been moved from 66 Broadway to the new West Street building, 90 West street.

The H. F. Vogel Contracting & Railway Supply Co., St. Louis, Mo., has received an order from the Ozan Lumber Co., of St. Louis, for twenty-five 40-ft. flat cars. They will be built by the Danville Car Co., Danville, Ill.

Among recent improvements in the car stations of the International Railway at Buffalo are four Northern three-motor electric traveling cranes of 10 tons capacity and one overhead electric track and trolley. These were furnished by the Northern Engineering Works, crane builders, Detroit, Mich.

On April 23d the main building of the machine shop of the Indianapolis Switch & Frog Co., Springfield, Ohio, was practically destroyed by fire. This building was 400 x 225 ft., and will be rebuilt at once as a fireproof structure. There was almost no loss of material or work in course of erection, and temporary arrangements are being made to complete, as far as possible, unfinished orders.

Henry Rohwer has opened an office as consulting civil engineer at 1321 Wright Building, St. Louis, Mo. Mr. Rohwer has had wide experience in all branches of railroad and municipal engineering. He entered railroad service in 1869 as topographer on surveys with the Burlington & Missouri River and remained with that road for five years. From 1877 to 1881 he was City Engineer of Omaha, Neb., and during that time he planned and supervised the building of the water works and sewage systems for the city. Later he went to the Oregon Short Line as Resident Engineer in charge of new construction, resigning to go to the Missouri Pacific as Assistant Engineer of Maintenance of Way. In 1901 he was appointed Chief Engineer of the Missouri Pacific and in 1905 Consulting Engineer for the same company. He has been associated with the St. Louis Municipal Bridge and Terminal Commission in the selection of a site for the new municipal bridge across the Mississippi river, for which $3,500,000 in bonds have been voted by the city.

Iron and Steel.

Cuban roads have recently bought 2,000 tons of rails for delivery this year.

The Chicago Union Traction Company has given an order for 10,000 tons of grooved rails.

The Harriman lines are reported to be making inquiries for rails. Only open hearth rails are wanted.

J. G. White & Co., New York, are about to order 3,700 tons of 60-lb. rails and accessories, 90 switches with frogs and 1,000 tons of steel bridges for the Philippine Railway.

The Carnegie Steel Company has an order for 46,000 tons of standard rails from the Savannah, Augusta & Northern for shipment during 1907 and 1908. Several smaller lots have also been booked, aggregating 3,000 tons, for early shipment.

Bids are to be opened next week for several thousand tons of steel for the Manhattan approach to the Blackwell's Island bridge, New York. The Brooklyn Rapid Transit Company is in the market for 1,200 tons of structural steel, and the Interborough Rapid Transit Company for 3,000 tons. It is estimated that orders are now pending for nearly 100,000 tons of structural steel.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Mechanical Engineers.

The spring meeting of this society is to be held in Indianapolis, Ind., May 28-31. The headquarters and meetings are to be in the Claypool Hotel, where 75 rooms have been reserved for convention guests. A number of excursions to points of interest in and around Indianapolis have been arranged; full information will be found in the June "Proceedings." At a business session to be held May 29, committee reports are to be made on the following subjects:

"Standard Proportions for Machine Screws."

"Preliminary Report of the Committee on Refrigerating Machines."

"Collapsing Pressures of Lap-Welded Steel Tubes," Reid T. Stewart.

"The Balancing of Pumping Engines," A. F. Nagle.

"A Comparison of Long and Short Rotary Kilns," E. C. Soper.

At the meeting to be held on the evening of the same day the subject is to be automobiles, and papers are to be presented as follows:

"Bearings and Moving Mechanism," Henry Hess.

"Air Cooling of Automobile Engines," John Wilkinson.

"Materials for Automobiles," Elwood Haynes.

"Special Auto Steel," T. J. Fay.

"Railway Motor Car," B. D. Gray.

At the next session the subject is to be Superheated Steam; the papers to be read are as follows:

"The Specific Heat of Superheated Steam," A. R. Dodge.

"Determination of Entropy Lines for Superheated Steam," A. M. Greene.

"The Flow of Superheated Steam in Pipes," E. H. Foster.

"Co-relation of Furnace and Superheated Conditions," R. P. Bolton.

"The Heating of Storehouses," H. O. Lacount.

Thursday afternoon is to be devoted to excursions; on the following day a visit is to be made to Purdue University, Lafayette, Ind. A professional session is to be held in one of the university buildings, at which papers on the following subjects are to be read: "Performance of Cole Superheaters," W. F. M. Goss; "Experiences with Superheated Steam," G. H. Barrus; "Use of Superheated Steam on Locomotives in America," H. H. Vaughan; "Superheated Steam in an Injector," S. L. Kneass; "A. Hirn's Analysis of Locomotive Test," S. A. Reeve.

The University of Illinois extends to the members of the society attending the convention in Indianapolis a cordial invitation to visit the university, where they will be received by Dr. L. P. Breckenridge, Professor of Mechanical Engineering and Director of the Government Research Station.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Ann Arbor.—See Detroit, Toledo & Ironton.

Arkansas Southeastern.—J. S. Burch has been appointed General Freight and Passenger Agent, with office at Randolph, La.; effective April 1, 1907.

Atchison, Topeka & Santa Fe.—C. W. Kouns, Superintendent of Transportation, has been appointed also to the new office of Assistant to the Second Vice-President, with office at Chicago.

Broxton, Hazlehurst & Savannah.—The officers of this company, which bought the line formerly known as the Ocilla & Valdosta, are as follows: H. C. McFadden, President and General Manager; W. N. Smith, Superintendent; C. B. Gwyn, Auditor, all with offices at Fitzgerald, Ga.; J. J. Hazel, Master Mechanic, with office at Ocilla, Ga. The President and General Manager has direct supervision over traffic.

Central Railroad of New Jersey.—J. E. Brokaw, Assistant General Auditor, has been appointed Auditor of Disbursements, succeeding G. O. Waterman, Jr., resigned. D. H. MacFarland succeeds Mr. Brokaw. The offices of both are at Philadelphia, Pa.

Chattanooga Southern.—W. W. Kent, who is one of the two Receivers recently appointed for this company, will hold also the titles of General Manager and General Freight and Passenger Agent, the duties of which offices he will perform.

Chesapeake & Ohio.—David C. Green, Assistant Secretary, has resigned.

Chicago & North-Western.—The executive and financial offices in New York of this company and of the Chicago, St. Paul, Minneapolis & Omaha have been moved to 111 Broadway.

Chicago, St. Paul, Minneapolis & Omaha.—See Chicago & North-Western.

Colorado & Wyoming.—J. F. Welborn has been elected President and D. C. Beaman, Vice-President, of this company and of the Crystal River Railroad, both with offices at Denver, Colo. R. L. Hearon has been appointed Traffic Manager of both roads, with office at Denver.

Crystal River.—See Colorado & Wyoming.

Detroit, Toledo & Ironton.—The offices of the following officials of this company and of the Ann Arbor Railroad have been moved from Toledo to Detroit: President, General Manager, Auditor, General Traffic Manager, General Passenger Agent and Assistant General Freight Agent.

Dublin & Southwestern.—M. T. Lanigan has been appointed Auditor of this company and of the Wrightsville & Tennille, with office at Tennille, Ga., succeeding Otis Ellison, resigned.

East Tennessee & Western North Carolina.—The offices of F. P. Howe, President, and J. S. Wise, Secretary and Treasurer, have been removed from Philadelphia to Johnson City, Tenn.

Gila Valley, Globe & Northern.—See Phoenix & Eastern.

Jackson & Northern.—A. S. McCombe has been appointed Assistant Secretary and Treasurer, with office at Pittsburg, Pa., succeeding W. B. Goucher, resigned.

Manistique, Marquette & Northern.—C. H. Cox has been appointed Auditor, with office at Manistique, Mich., succeeding W. C. J. Bienemann, promoted.

Mobile, Jackson & Kansas City.—W. D. Stratton, Chairman of the Board, has been elected also First Vice-President, with office at New York City. Eugene Harvey has been elected Assistant Secretary and Treasurer, with office at Mobile, Ala., succeeding S. B. Murray, resigned.

New Orleans, Fort Jackson & Grand Isle.—H. C. Warmoth, President, has resigned.

Orange & Northwestern.—P. Baber, Auditor, has resigned.

Phoenix & Eastern.—Epes Randolph, President of various Southern Pacific lines in Arizona, has been elected also President of the Phoenix & Eastern, which the Southern Pacific recently bought from the Atchison, Topeka & Santa Fe. W. A. Drake, Vice-President and Assistant General Manager of the Phoenix & Eastern, has resigned, and the office has been abolished. The duties of the position will be hereafter performed by Mr. Randolph. The authorities of the following officials of the Gila Valley, Globe & Northern have been extended over the Phoenix & Eastern. E. A. McFarland, Chief Engineer; J. W. Small, Superintendent of Motive Power; C. E. Walker, Purchasing Agent, and J. C. McClure, Engineer of Maintenance of Way. C. M. Scott has been appointed Superintendent.

Texarkana & Fort Smith.—P. E. Woolley has been appointed Auditor, succeeding E. P. Hall, resigned to go to the Kansas City Southern.

Williamsville, Greenville & St. Louis.—W. B. Rose has been elected Vice-President and General Manager, with office at St. Louis, Mo. A. C. Delano has been appointed Superintendent and Auditor, with office at Greenville, Mo.

Wisconsin Central.—F. E. Dewey, Assistant to the President, has resigned.

Wrightsville & Tennille.—See Dublin & Southwestern.

Operating Officers.

Canadian Northern.—E. A. James, General Manager, having been granted extended leave of absence on account of ill health, D. B. Hanna, Third Vice-President, will for the present perform also the duties of General Manager.

Erie.—W. J. Sharp, Superintendent at Hornell, N. Y., has been appointed Superintendent at Rochester, N. Y., succeeding J. C. Tucker, resigned on account of ill health. R. S. Parsons, Assistant General Superintendent at Cleveland, Ohio, succeeds Mr. Sharp, and his former title has been abolished.

W. C. Hayes, Superintendent of the Delaware division, has been appointed also Superintendent of the Jefferson division, with office as before at Susquehanna, Pa.

Grand Trunk.—U. E. Gillen, Assistant Superintendent at London, Ont., has been appointed Superintendent of the Middle division, succeeding W. G. Brownlee, promoted. A. J. Nixon, Trainmaster at Stratford, Ont., succeeds Mr. Gillen. C. G. Bowker succeeds Mr. Nixon.

Grand Trunk Pacific.—M. C. Sturtevant, General Assistant, has resigned to go into private business as a railroad contractor, and his former position has been abolished.

Lake Shore & Michigan Southern.—J. M. Horgan, Trainmaster of the Western division, has been appointed Trainmaster of the Franklin division, with office at Ashtabula, Ohio, succeeding J. H. Reynolds, transferred. J. W. Britt, assistant trainmaster of the Eastern division, succeeds Mr. Horgan.

Lehigh & New England.—A. S. Wright, Car Accountant, has resigned to go to another company and his former position has been abolished.

Mexican Central.—R. N. Elliott, having returned from leave of absence, has been reappointed Superintendent of Terminals at Tampico, succeeding W. T. East, who has been Acting Superintendent of Terminals during the absence of Mr. Elliott.

Mobile, Jackson & Kansas City.—J. H. Garner has been appointed Trainmaster, succeeding P. M. Seay, resigned.

New York, New Haven & Hartford.—J. P. Hopson, Superintendent of the Berkshire and Naugatuck divisions, has been appointed Superintendent of the New York division, with office at New York, succeeding A. R. Whaley, resigned to go to the New York Central & Hudson River.

Norfolk & Southern.—The office of R. P. Foster, Assistant General Superintendent, has been removed from Goldsboro, N. C., to New Bern, N. C. S. L. Dill, Superintendent of the Beaufort division, has been appointed General Agent of the transportation and traffic departments, with office at New Bern. J. R. Hawkins succeeds Mr. Dill.

Pittsburg, Westmoreland & Somerset.—Lauros H. Allen, Secretary, has been appointed also General Manager, succeeding N. Byers. Chas. H. Balme has been appointed Assistant to the General Manager.

Rio Grande Southern.—A. S. Meldrum has been appointed General Superintendent, with office at Ridgway, Colo.

Seaboard Air Line.—J. H. Witt, Superintendent of the Third division, has been appointed Superintendent of the First division, with office at Richmond, Va., succeeding W. R. Hudson. W. A. Gore succeeds Mr. Witt, with office at Abbeville, S. C. The office of J. M. Shea, Superintendent of the Second division, has been removed from Raleigh to Hamlet, N. C.

Tehuantepec National.—W. M. Cartwright has been appointed Superintendent of Transportation, succeeding to the duties of C. Greene, formerly Superintendent, with office at Rincon Antonio, Oaxaca. H. O'Connor, Auditor, has been appointed also Car Accountant, succeeding E. J. Ford.

Wisconsin Central.—A. J. Van Valkenburg, Superintendent of the Northern division, has been appointed Superintendent of Transportation, with office at Milwaukee. O. W. Johnstone succeeds Mr. Van Valkenburg, with office at Abbotsford, Wis. C. M. Winter has been appointed Superintendent of the Southern division, with office at Fond du Lac, Wis., succeeding A. R. Horn.

Traffic Officers.

Beaumont, Sour Lake & Western.—Roy Terrell has been appointed General Freight and Passenger Agent, with office at Beaumont, Tex.

Bessemer & Lake Erie.—F. C. Baird has been appointed General Freight Agent, with office at Pittsburg, Pa., succeeding O. J. Hammon, resigned.

Erie.—T. F. Powell has been appointed General Agent at Jamestown, N. Y.

Georgia, Florida & Alabama.—J. H. McWilliams has been appointed Traffic Manager, and the office of General Freight and Passenger Agent, previously held by him, has been abolished.

Michigan Central.—C. C. Griggs, commercial agent at Detroit, has been appointed Assistant General Freight Agent at Detroit, succeeding C. J. Hupp, promoted.

Newton & Northwestern.—C. H. Crooks has been appointed General Freight and Passenger Agent, with office at Boone, Iowa, succeeding W. H. Benn, resigned to engage in other business.

Engineering and Rolling Stock Officers.

Chicago, Indiana & Southern.—B. C. Rich, Assistant Chief Engineer, has been appointed Chief Engineer, with office at Gibson, Ind. Byron Layton, Engineer of Maintenance of Way, has been appointed Signal Engineer, with office at Gibson, Ind.

Erie.—E. A. Wescott has been appointed Assistant Mechanical Superintendent, with office at Meadville, Pa.

G. H. Burgess, Engineer of Terminal Improvements at New York, has resigned, to go into other business.

Missouri Pacific.—Henry Rohwer, Consulting Engineer, has resigned to go into private business as a consulting engineer at St. Louis.

Mobile & Ohio.—The office of C. F. Blue, Superintendent of Way and Structures, has been removed from St. Louis to Mobile, Ala.

New York Central & Hudson River.—C. E. Lindsay, Division Engineer of the Mohawk division, has been appointed Engineer of Maintenance of Way of the Electric Division, with office at New York. J. D. Newbert succeeds Mr. Lindsay, with office at Albany, N. Y.

Northern Pacific.—A. C. Terrell has been appointed Division Engineer at Spokane, Wash., in charge of the lines between Ellensburg and Trout Creek, succeeding L. S. Oakes, resigned to go to a construction company.

LOCOMOTIVE BUILDING.

The Manufacturers' Railway, of St. Louis, is said to have ordered three locomotives.

The Long Island has ordered five locomotives from the American Locomotive Company.

The Indiana Steel Company, Chicago, is in the market for 12 switching locomotives.

The United Verde & Pacific has ordered one locomotive from the Baldwin Locomotive Works.

The Lehigh & Hudson River has ordered 12 locomotives from the Baldwin Locomotive Works.

The Victoria, Fisher & Western has ordered one locomotive from the Baldwin Locomotive Works.

The Rio Tinto Company, Ltd., has ordered four locomotives from the Baldwin Locomotive Works.

The Illinois Northern has ordered one locomotive from the Lima Locomotive & Machine Company.

The Minnesota Transfer has ordered four switching locomotives from the American Locomotive Company.

The Calumet & Southeastern has ordered one locomotive from the Lima Locomotive & Machine Company.

The Ouachita Navigation & Logging Company, Felsenthal, Ark., is in the market for one 15 to 30-ton locomotive.

The Duluth, South Shore & Atlantic has ordered nine consolidation locomotives from the Baldwin Locomotive Works.

The Tennessee Copper Company, New York, has ordered one locomotive from the American Locomotive Company.

The American Smelters Securities Company has ordered five locomotives from the American Locomotive Company.

The Granite City & Mississippi River has ordered one switching locomotive from the Hicks Locomotive & Car Works.

The Carnegie Steel Company, Pittsburg, has ordered two additional locomotives from the Baldwin Locomotive Works.

The Lyon Cypress Lumber Company, Garryville, La., has ordered one mogul locomotive from the Baldwin Locomotive Works.

The J. D. MacArthur Company, Winnipeg, has ordered one 10-wheel locomotive from the Hicks Locomotive & Car Works.

The Moron Sugar & Land Co., Cuba, of which J. J. Warren, of Havana, is President, is in the market for broad gage locomotives.

The Saddle Mountain Railway, Arizona, has ordered one narrow gage saddle tank locomotive from the Hicks Locomotive & Car Works.

The Chicago & Milwaukee Electric, as reported in the *Railroad Gazette* of March 1, has ordered two switching locomotives from the Hicks Locomotive & Car Works.

The Stewart Sugar Co. (formerly the Silviera Sugar Co.) has ordered four 50-ton mogul locomotives from the Baldwin Locomotive Works for its plantation railroad in Cuba.

The Japanese Government Railways administration is in the market for 24 locomotives. The contract will be placed through Mitsui & Co., or one of the other Japanese export houses having New York offices.

The Chicago, Lake Shore & Eastern has ordered eight simple consolidation and 12 six-wheel switching locomotives from the American Locomotive Co. Specifications for these locomotives were published in the *Railroad Gazette* of April 26.

J. G. White & Co., New York, are about to order for the Philippine Railway six mogul 3-ft. 6-in. gage locomotives. These engines will weigh 60,000 lbs. and their coal capacity will be four tons and water capacity 2,500 gallons. The other specifications are similar to those of the four locomotives ordered last fall.

The Rio Tinto Company has placed a contract direct with the Baldwin Locomotive Works for four locomotives. Formerly contracts were placed principally through the British firm of Vivian Bond & Co., 68 Beaver street, New York, but after this all requirements in this market will be ordered direct from the mines in Spain or through the London headquarters.

The Mobile & Ohio has ordered from the Baldwin Locomotive Works for October, 1907, delivery, 20 ten-wheel simple locomotives. The specifications are as follows:

General Dimensions.

Type of locomotive	Ten-wheel
Weight, total	170,000 lbs.
Weight, on drivers	130,000 "
Diameter of drivers	62 in.
Cylinders	21 in. x 28 in.
Boiler, type	Wagon top
" working steam pressure	200 lbs.
" number of tubes	361
" diameter of tubes	2 in.
" length of tubes	15 ft.
Firebox, length	120 3/16 in.
" width	41 1/8 in.
" grate area	34.3 sq.ft.
Heating surface, total	2,944 "
Water capacity	7,000 gals.
Coal capacity	15 tons

Special Equipment.

Axles	Otis steel
Bell ringer	Western
Boiler—Steel	Otis
Boiler check valve	Hancock
Brakes	Westinghouse
Couplers—Pilot	Gould
Couplers—Tender	Washburn
Crank pins	Otis steel
Draft rigging	Miner
Headlights	Pyle-National
Injectors	Monitor
Journal bearings	Eureka bronze
Pilot beams	Commonwealth cast-steel
Piston rods	Otis steel
Safety valves	Consolidated
Oil box on tender	Symington
Valves	Richardson
Sanding devices	Leach
Lubricators	Nathan
Springs	Railway Steel-Spring Co.
Steam gages	Ashcroft
Tires	Midvale
Wheels, truck and tender	Paige
Brake-shoes—Drivers	Perfecto
Brake-shoes—Tender.	Streetor

The Yokohama Railroad has ordered from the American Locomotive Company for December, 1907, delivery, five simple (2-6-2) tank 3-ft. 6-in. gage locomotives. The specifications are as follows:

General Dimensions.

Type of locomotive	Tank locomotive
Weight on drivers	67,000 lbs.
Total weight	87,000 "
Diameter of cylinders	15 in.
Stroke of pistons.	22 "
Diameter of drivers	52 "
Boiler, type	Straight top radial
" working steam pressure	160 lbs.
Heating surface, total	826 sq. ft.
Tubes, number	171
" material	Brass
" maker	either American Tube Co., Benedict & Burnham or Coe Brass Mfg. Co.
" outside diameter	1¾ in.
" length	9 ft. 8 in.
Firebox, length	70 "
" width	28¾ "
" material	Copper
" maker	either Park Steel Co., Hendricks Bros., Benedict & Burnham, or Coe Brass Mfg. Co.
Grate area	14 sq. ft.
Tank capacity for water	1,200 gals.
Coal capacity	1¼ tons

Special Equipment.

Vacuum brakes	New York
Boiler lagging	Sectional magnesia
Couplers	Hook and screw coupling
Injector	Sellers
Sight-feed lubricators	Nathan
Springs	either Pickering Spring Co., Charles Scott Spring Co., A. French Spring Co., or Diamond State Car Spg. Co.
Tires, driving wheels	either Standard Steel Works, Latrobe Steel Works, or Midvale Steel Co.

CAR BUILDING.

The Colorado & Southern is in the market for two dining cars.

The Manufacturers' Railway of St. Louis is said to have ordered 200 refrigerator cars.

The Morgantown & Kingwood is said to be in the market for 500 steel hopper cars.

The Baton Rouge (La.) Electric Gas Co. has ordered nine cars from the St. Louis Car Co.

The Pacific & Idaho Northern has ordered three Hart convertible cars from the Rodger Ballast Car Co.

The Buffalo Creek & Gauley, Clay, W. Va., has ordered two Hart convertible cars from the Rodger Ballast Car Co.

B. P. Cheney, a Director of the Atchison, Topeka & Santa Fe, has ordered one private car from the Pullman Co.

The Moron Sugar & Land Co., Cuba, of which J. J. Warren, of Havana, is President, is in the market for cane cars.

The Atchison, Topeka & Santa Fe has ordered 50 bunk cars from the Chicago, New York & Boston Refrigerator Company.

The Lyon Cypress Lumber Company, Garryville, La., has ordered 12 flat cars from the Russel Wheel & Foundry Company.

The Cordova Central has placed a contract with the American Car & Foundry Co. for several passenger and freight cars.

The Atlantic Coast Line has ordered 50 low side gondolas of 60,000 lbs. capacity from the Hicks Locomotive & Car Works.

The Fairchild & Northeastern has ordered five 41-ft. flat cars of 60,000 lbs. capacity from the Hicks Locomotive & Car Works.

The El Paso & Southwestern has ordered 27 steel underframe tank cars of 80,000 lbs. capacity from the E. A. Bryan Company.

The Portland Railway, Portland, Ore., has ordered 15 41-ft. flat cars and 10 36-ft. flat cars from the Hicks Locomotive & Car Works.

The Associated Oil Company, San Francisco, Cal., has ordered 40 steel underframe tank cars of 80,000 lbs. capacity from the E. A. Bryan Company.

The Ouachita Navigation & Logging Company, Felsenthal, Ark., is in the market for 15 new or second hand logging cars from 40,000 to 60,000 lbs. capacity.

The Idaho & Washington Northern, Coeur d'Alene, Idaho, has ordered two first class coaches, one smoking car and one baggage car from the Pullman Co.

The Starkes' Heater Car Company, Chicago, as reported in the *Railroad Gazette* of May 3, has increased its requisition for prices on 25 special freight cars to 100.

The Portland Railway, Light & Power Company, Portland, Ore., is said to have ordered 40 flat cars of 60,000 lbs. capacity from the American Car & Foundry Co.

The Wilkesbarre & Hazelton has ordered four wooden gondolas of 60,000 lbs. capacity, three box cars and one flat car of 50,000 lbs. capacity from the Hicks Locomotive & Car Works.

The Spadra (Ark.) Creek Coal Co. is in the market for four steam motor cars and four trailers for a new eight-mile line between Clarksville and Spadra. The contract will be placed by M. L. Mardis, Vice-President of the company.

The Louisiana Railway & Navigation Company has asked bids on 500 wooden box cars of 60,000 lbs. capacity. These cars will be 37 ft. 10 in. long, 8 ft. 3 in. wide and 6 ft. 11½ in. high, inside measurements. The special equipment includes Carnegie steel axles.

The Illinois Central, as reported in the *Railroad Gazette* of March 29, has ordered two dining cars from the Pullman Co.; the order for 15 day coaches is indefinitely postponed. The company is also ordering material for 400 box cars to be built at its own shops.

The Pennsylvania has ordered 60 coaches, 20 baggage and five combination passenger and baggage cars from the Pressed Steel Car Co., 90 coaches from the American Car & Foundry Co., and will build five coaches at the Altoona shops. These cars will be of steel construction throughout.

The Milwaukee Refrigerator Transit Company, Milwaukee, as reported in the *Railroad Gazette* of May 3, is building 100 refrigerator cars of 60,000 lbs. capacity at its own shops. These cars will measure 36 ft. long, 9 ft. wide and 10 ft. high, outside measurements. The special equipment includes:

Bolsters	Bettendorf
Couplers	Latrobe
Draft rigging	Farlow
Journal boxes	Bettendorf
Trucks	Bettendorf

The Mobile & Ohio, as reported in the *Railroad Gazette* of April 12, has ordered from the American Car & Foundry Company, for September, 1907, delivery, 750 gondolas of 80,000 lbs. capacity, and 1,000 box cars of 60,000 lbs. capacity. The gondolas will weigh 33,700 lbs. and will measure 37 ft. 1½ in. long, 9 ft. 8 in. wide and 3 ft. 9 in. high, inside measurements, and 40 ft. long over all. The box cars will weigh 33,000 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements, and 36 ft. 10 in. long, 9 ft. 6½ in. wide and 12 ft. 6¾ in. high, over all. The bodies and underframes of all cars will be of wood. The box cars will have one end door. The center plates and side bearings of all cars will be cast integral with the bolsters. The special equipment includes:

Bolsters	Cast steel
Brake-beams	Simplex
Brakes	Westinghouse
Brake-jaws	Western Railway Equipment Co.
Brasses	Eureka bronze, lead-lined
Couplers	Latrobe steel
Doors, box car	Jones
Draft rigging	Miner
Dust guards	Harrison
Journal boxes	Franklin
Paint	St. Louis Surfacer Co.
Sill pockets	Western Railway Equipment Co.
Springs	Railway Steel-Spring Co.
Trucks—Gondola	Cast steel side frames
Trucks—Box	Arch bar

The Missouri, Kansas & Texas, as reported in the *Railroad Gazette* of March 15, has ordered 2,000 box cars of 60,000 lbs. capacity, 900 gondolas of 100,000 lbs. capacity, and 100 dump coal cars of 80,000 lbs. capacity from the American Car & Foundry Company for September and October delivery. The box cars will weigh 36,000 lbs. and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The gondolas will weigh 42,000 lbs. and will measure 42 ft. long, 9 ft. 4 in. wide and 4 ft. 2½ in. high, inside measurements. The dump coal cars will weigh 38,000 lbs. and will measure 36 ft. long, 9 ft. 4 in. wide and 5 ft. high, inside measurements. The special equipment for all includes:

Bolsters	American steel
Brake-beams	Damascus
Brake-shoes	Sargent
Brasses	Climax
Couplers	Major
Door fastenings for box cars	Positive
Doors for box cars	Security
Draft rigging	Miner
Dust guards	Security
Journal boxes	Symington
Paint	Sherwin-Williams
Roofs for box cars	Chicago; Cleveland inside
Wheels	American Car & Foundry

RAILROAD STRUCTURES.

LAREDO, TEX.—The National of Mexico, according to reports, has plans made for a second railroad bridge, to be built over the Rio Grande at this place, to cost about $500,000. The proposed joint bridge to be built by the National and the St. Louis, Brownsville & Mexico, for which plans were made some time ago and approved by the Mexican Government, is still under consideration.

NEEDLES, CAL.—The Atchison, Topeka & Santa Fe, it is said, will build a new bridge over the Colorado river at this place.

PEORIA, ILL.—The Chicago, Rock Island & Pacific has bought land in Peoria as a site for new yards and passenger and freight terminals.

PIERRE, S. DAK.—The Chicago & North-Western, it is said, is making surveys for new shops to be built during the coming summer at a cost of over $200,000.

ST. LOUIS, MO.—The Wabash, which last year built a new freight house at Fourth and Franklin streets, will make further improvements, to include a new freight house 75 ft. x 646 ft., on Collins street, extending from Franklin avenue to Carr street.

SAN FRANCISCO, CAL.—Local reports state that the Western Pacific has decided to at once begin the construction of its terminal at Oakland. The work will involve the filling of a mole 1,000 ft. wide between 4,000 and 5,000 ft. long, and includes a new station with slip approaches at the western end. The work, which will take about 18 months to complete, will cost in the neighborhood of $2,500,000.

WINNIPEG, MAN.—The Canadian Pacific has given to Contractor McDiarmid, of Winnipeg, contracts for putting up roundhouses on its line at Cranbrook, Coleridge, Strathcona and Swift Current.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—The Texas Legislature has granted the Southern Kansas Railway Company of Texas permission to take up the track on that portion of its line formerly known as the "Panhandle Railway" from a point 1.25 miles west of Panhandle, Tex., to Washburn, 14.3 miles, and to build a new line from the point 1.25 miles west of Panhandle to Amarillo, a distance of 25 miles. Excepting the preliminary survey, no work has been done on this line. The President of the S. K. is J. E. Hurley, Topeka, Kan., General Manager of the Atchison. Work will probably be started soon; no contracts have been let. (April 26, p. 598.)

According to W. B. Jansen, Fourth Vice-President, the appropriation for new work on the Santa Fe lines this year is $2,000,000 instead of $10,000,000, which the management had intended spending on improvements.

ATCHISON, TOPEKA & SANTA FE (COAST LINES).—It is reported that this company is planning to build an extension of the line running from Kramer, Cal., north to Randsburg. The proposed extension is from Randsburg northeast to Ballarat, in Death Valley, about 75 miles, through a mining region.

BESSEMER & LAKE ERIE.—Construction work on the Western Allegheny, the new line connecting Butler and New Castle, Pa., has been finished and the road is to be put in operation in a short time. It was built to give the B. & L. E. entrance into the furnace district in the vicinity of Youngstown.

BLUE VALLEY.—Incorporated in Missouri with $100,000 capital and office at Kansas City, Mo., to build five miles of railroad in Jackson County. The incorporators include A. Massey, E. L. Browne, J. S. Chick, Jr., J. Georgen and W. E. Winner.

BOSTON ELEVATED.—At a recent meeting of the stockholders, it was voted to issue stock to provide for the construction of the Cambridge subway, to extend the elevated line to Forest Hills, and for power additions and other improvements.

CANADIAN PACIFIC.—It is reported that this company is negotiating to buy the Owen Sound & Meaford, projected from Owen Sound, Ont., on the Canadian Pacific east 18 miles to Meaford, on

the Grand Trunk. The O. S. & M. has recently been granted a subsidy of $90,000 by the Dominion Government.

CHENANGO VALLEY (ELECTRIC).—Incorporated in New Jersey with $100,000 capital to build an electric line from Hamilton, N. Y., south to Binghamton, about 55 miles. The incorporators include: H. O. Coughlan, J. R. Turner and L. H. Gunther.

CHICAGO & EASTERN ILLINOIS.—Henry I. Miller, President of this company, has confirmed the report that surveys are being made for a line to connect this road, by way of Evansville and Joppa, with the Mobile, Jackson & Kansas City. This would give a short route between Chicago and New Orleans and Chicago and Mobile.

CHICAGO, MILWAUKEE & GARY.—See Illinois, Iowa & Minnesota.

DENVER & GULF.—Incorporated in Oklahoma with $2,000,000 capital to build from Denver, Colo., southeast to Snyder, Okla., about 500 miles. The office of the company is at Texhoma, Okla. F. Banks, of Sweetwater, Tex.; W. E. Wilson, of Prentiss; W. R. Evans, J. Hicks and C. Gleem, of Texhoma, and R. E. Davis, of Granite, incorporators.

EL RENO, OKLAHOMA & SHAWNEE.—Incorporated in Oklahoma, with office at Oklahoma City, and capital of $2,500,000, to build a line from El Reno via Oklahoma City to Shawnee, 75 miles, with a branch south to Norman, 20 miles. The incorporators include: S. P. McIntyre, N. M. Elds, J. N. Martin, E. E. Houghton and J. M. Wright, of Oklahoma City.

GRAND TRUNK PACIFIC.—Preliminary surveys are being made by this company on the line of the Pacific, Omineca & Northern route from the head of Kitamat Arm, British Columbia, north about 125 miles to Hazleton, on the Skeena river. The charter rights of this road were bought about two years ago by the G. T. P., but since then nothing has been done. The route is needed by the G. T. P. to secure proper transportation for the construction supplies for the main line to the interior owing to the insecurity of navigation on the Skeena river.

IDAHO.—Incorporated in Idaho with $4,500,000 capital, to build a line from Boise east, thence north to the Sawtooth mountains, in Custer County, approximately 150 miles. The incorporators include: L. A. Coate and H. E. Neal, of Boise, Idaho; A. M. Bannister and C. F. Hunter, of Detroit, Mich.

ILLINOIS, INDIANA & GARY.—See Illinois, Iowa & Minnesota.

ILLINOIS, IOWA & MINNESOTA.—J. H. Seaman, President of this company, announces that the proposed Rockford Belt, the Illinois, Indiana & Gary, and the Milwaukee & Rockford, have been consolidated with this company. At the annual meeting announcement is to be made of a change in the name of the consolidated system to the Chicago, Milwaukee & Gary Railroad Co. The total mileage embraced in the system will be about 300 miles. The I., I. & M. now operates 125 miles. An extension from Rockford, Ill., to Milwaukee and another to Gary, Ind., will soon be built.

ILLINOIS TRACTION.—This system, which operates various lines from Danville, Ill., southwest to St. Louis, Mo., with a branch from Danville south to Ridgefarm, and an east branch from Staunton to Hillsboro, also one from Decatur north to Bloomington, a total of about 295 miles, has just finished an extension from Bloomington northwest to Peoria, 42 miles. The company has projected a line from Champaign northwest to Bloomington, also one from Bloomington southwest to Springfield, thence west to Jacksonville, and a north connecting line from Lincoln to Peoria, aggregating 250 miles. Considerable improvement work is also contemplated in St. Louis, Mo.

INDIANAPOLIS, LOGANSPORT & CHICAGO.—An officer writes that contracts are to be let in July or August for building this line. The projected route is from Logansport, Ind., south through Young America, Russiaville, Kempton and Sheridan to Indianapolis, 68 miles. Maximum grades will be seven-tenths of 1 per cent. and maximum curves 3 deg. E. N. Talbot is President and W. A. Osmer, Chief Engineer, Logansport, Ind.

INDIANA ROADS (ELECTRIC).—A number of Indianapolis capitalists are organizing a company to have a capital of $4,000,000 to build an interurban road from Terre Haute, Ind., via Crawfordsville and Frankfort to Kokomo, about 100 miles.

INTERCOLONIAL.—Bids are wanted May 10 by D. Pottinger, General Manager, Moncton, N. B., for double-tracking the main line of this road between Moncton, N. B., and Painsec Junction, seven miles.

KANSAS CITY, MEXICO & ORIENT.—President A. E. Stilwell, of this company, has announced that all of the necessary material has been bought to place the line in operation from Emporia, Kan., south to San Angelo, Tex., this year; and the company hopes to have the work finished so that by temporarily securing trackage rights from Wichita to El Dorado, 30 miles, and from Emporia to Kansas City, 114 miles, through trains may be run from Kansas City to San Angelo by the end of this year. Grading on this entire section, which will be 711 miles long, is about finished. The road is now in operation from Wichita south to Clinton, 192 miles, and from Knox City south to Sweetwater, 76 miles. The company also expects to connect the southern end of this road, in operation as far north as Eloro, with the Southern Pacific at Alpine, so that work can be started from that point north to complete the gap of 229 miles between Alpine and San Angelo.

LOUISIANA EAST & WEST.—See Texas & Pacific.

MANILA RAILROAD.—An officer announces that grading was started March 21 on the proposed lines on the Island of Luzon, aggregating 428 miles, to be built by the syndicate formed by Speyer & Co., New York. No contracts for any of the work are to be let, as the company is building the line with its own men. (March 15, p. 386.)

MANUFACTURERS' RAILWAY.—See West End Terminal.

MEXICAN ROADS.—The state of Chihuahua has granted a concession to Rudolfo Valles, of Parral, to build a railroad from Morita, on the Jiminez-Parral branch of the Mexican Central, south to Allende, 20 miles. It is stated that the Los Colorados Mining Company, which has large mining properties at Allende, is backing the railroad enterprise.

MEXICO, PERRY & SANTA FE TRACTION.—This company, with office in Mexico, Mo., is to soon start work on a line from Mexico northeast to Perry, 20 miles. S. L. Robinson, Belleville, is President and General Manager; C. W. Gaither, St. Louis, First Vice-President; W. W. Mundy, Mexico, Mo., Second Vice-President; J. D. Bates, Centralia, Third Vice-President, and H. D. Ahlbrandt, St. Louis, Secretary and Treasurer.

MILWAUKEE & ROCKFORD.—See Illinois, Iowa & Minnesota.

MISSOURI, TENNESSEE & GEORGIA.—This company claims to have completed its financial arrangements and that surveys are to be started at once for its proposed line from Caruthersville, Mo., southeast through Tennessee to Florence, Ala., 150 miles. I. H. Dugan, President, Humboldt, Tenn. (April 26, p. 599.)

MOBILE, JACKSON & KANSAS CITY.—See Chicago & Eastern Illinois.

OWEN SOUND & MEAFORD.—See Canadian Pacific.

PACIFIC, OMINECA & NORTHERN.—See Grand Trunk Pacific.

PAN-AMERICAN.—It is announced that this line will probably be finished to the Guatemala border by July 1—several months earlier than was expected. Track laying is progressing at the rate of more than half a mile a day. The line will soon be finished to Esquintla. The same interests have obtained a concession from the government of Guatemala to extend the line through that country to the city of Guatemala. Owing to the existing disturbed condition of political affairs in that country it may be some time before work is begun on the Guatemala division.

PHILADELPHIA & READING.—Local reports state that work on the elevated structure to be put up by this company to abolish the grade crossings in Philadelphia between Montgomery avenue and Cumberland street will be started shortly. At present there are nine crossings between these two streets. The company is to have a new freight yard in place of the two freight yards at Tenth and Berks streets and Broad and Huntingdon streets.

PHILADELPHIA & WESTERN (ELECTRIC).—This company, which was incorporated to build a line from Sixty-third and Market streets, Philadelphia, west to Parkesburg in Chester County, 45 miles, has finished the first 12½ miles from Philadelphia to Strafford. Preliminary tests are being made in preparation for the early operation of this section. W. R. Molinard, Vice-President and Chief Engineer, Philadelphia, Pa.

PIKE-LITTLE CREEK.—Incorporated in Kentucky to build from Beaver, on the Chesapeake & Ohio, in Pike County, Ky., to headwaters of Little creek, 15 miles. R. T. Little and J. C. Howard, Little Creek, Ky., incorporators.

ROCKFORD BELT.—See Illinois, Iowa & Minnesota.

ROCKY RIDGE.—An officer writes that this company has about finished its line from Rocky Ridge, Pa., on the East Broad Top Railroad, north to Evanston, five miles. R. S. Seibert, President, Orbisonia, Pa.

RUSSELL FORK.—Incorporated in Kentucky to build a line from a point on Russell Fork through the coal fields of Dickenson and Buchanan counties, Va., 35 miles. Surveys to begin at once. J. W. M. Stewart, of Ashland, is interested.

ST. LOUIS & ILLINOIS BELT.—See West End Terminal.

SOUTH DAKOTA CENTRAL.—This company, which has projected an extension from Rutland, S. Dak., north to Watertown, 75 miles, and which built six miles last year, has secured all of the necessary right of way. Work is now under way on the remainder of the line, and it is expected to be finished this year. (March 15, p. 392.)

Southern Kansas of Texas.—See Atchison, Topeka & Santa Fe.

Southern Pacific.—Local reports state that this company has about finished surveys and rights of way are being secured for a line from Fallon, Nev., east via Stillwater to Wonder Mines in Churchill County, and that work is soon to be started.

Syracuse & Chittenango (Electric).—Incorporated in New York with $500,000 capital and office at Syracuse. The company proposes to build an electric line from Syracuse to Chittenango. W. H. Dowe and G. S. Terry, of New York, and C. B. Everson, of Syracuse, Directors.

Tennessee & North Carolina.—An officer writes that this company is considering the question of building an extension of its road from Waterville, N. C., to Canton, but that no plans are being made for an extension from the northern end west towards Knoxville, Tenn. (April 26, p. 600.)

Texas & Pacific.—According to a statement of L. S. Thorne, Vice-President and General Manager of this company, the Louisiana East & West is to be operated as a part of the Avoyelles division of this road. The line which is being built from Bunkie, La., to Eunice, has been finished to Ville Platte, 16 miles from Eunice.

Toledo & Indiana Traction.—An officer writes that part of the right of way has been secured for the proposed extension from Bryan, Ohio, to Waterloo, Ind. It is uncertain when contracts for the work will be let, as litigation is necessary in Indiana to secure the balance of the right of way. (April 26, p. 600.)

Wagner, Lake Shore & Armour.—Incorporated in South Dakota with $1,000,000 capital and office at Wagner to build an electric line from Wagner, S. Dak., on the Chicago, Milwaukee & St. Paul north 65 miles, to Mitchell, which is on the same road and also on the Chicago, St. Paul, Minneapolis & Omaha; with a branch in Charles Mix County, west to the shore of Lake Andes. The incorporators include: A. H. Pease, J. Abasher and J. Steransky, of Wagner; A. Ammidson, of Lake Andes, and E. P. Wanzer, of Armour.

West End Terminal.—Under this name, a company has been organized in Missouri with a capital of $5,000,000 to build two bridges and a terminal belt line at St. Louis and East St. Louis. The plans include a bridge over the Mississippi river at a point south of the Missouri river; also a bridge over the same river at a point north of Jefferson Barracks, each to carry four tracks. A belt line is to be built paralleling the city limits and connecting the bridges. Negotiations are pending between this company, the Manufacturers' Railway and the St. Louis & Illinois Belt to merge the three companies. The Manufacturers' Railway is already planning extensive improvements in this section. The St. Louis & Illinois Belt has a large part of the right of way secured for its proposed line from Alton to Thebes, and eventually to Cairo, and it expects to begin the work shortly. The officers of the West End Terminal are: J. M. Denning, President, Des Moines, Iowa; W. L. Kennedy, Vice-President, St. Louis, Mo., and J. H. Hamilton, St. Louis, Mo., Secretary and Treasurer.

Western Allegheny.—See Bessemer & Lake Erie.

Wolcottville & Coldwater.—An officer writes that this company, which projected a line from Wolcottville, Ind., northeast to Coldwater, Mich., 35 miles, proposes to build the section from Wolcottville via Panama to Mongo, 18 miles, this year, and from that point to Coldwater next year. Surveys not yet made. O. G. Wales, President, Kansas City, Mo. (April 26, p. 600.)

RAILROAD CORPORATION NEWS.

Baltimore & Ohio.—See Chicago Terminal Transfer.

Brooklyn Rapid Transit.—See Coney Island & Brooklyn.

Chicago, Lake Shore & Eastern.—The capital stock of this company has been increased from $250,000 to $2,760,000. The increase is to retire $2,510,000 of its $4,620,000 bonds.

Chicago, Milwaukee & St. Paul.—See Wisconsin Central.

Chicago Terminal Transfer.—The Baltimore & Ohio has provided the United States Trust Company with funds to pay off the $15,100,000 first mortgage 4 per cent. bonds of the Chicago Terminal Transfer at par and interest. The property was to have been sold under foreclosure on May 3, but the action of the Baltimore & Ohio means an indefinite postponement of any such sale. The trust company began paying off the bonds on May 3. The principal and accrued interest on the bonds amounts to over $17,000,000. It is understood that the Baltimore & Ohio borrowed about $10,000,000 from New York bankers on 30 or 60-day notes. The company had on hand about $25,000,000 surplus, but it was so scattered that it was more convenient to borrow part of the money necessary for the retirement of the Chicago Terminal Transfer bonds. (Apr. 19, p. 566.)

Coney Island & Brooklyn (Electric).—This company has passed the current quarterly dividend on the $2,000,000 outstanding common stock. It is announced that earnings are to be spent in improvements. The company paid 2 per cent. in February, 1907; 8 per cent. in the year 1906; 10 per cent. in 1905, and 16 per cent. in each of the three preceding years. It owns 23 miles of road from Brooklyn to Coney Island, including branches, and is controlled by the Brooklyn Rapid Transit.

Havana Central (Electric).—See United of Havana.

Maine Central.—The stockholders have ratified the lease by the Maine Central of the Portland & Rumford Falls Railroad. The last named company has leased the Portland & Rumford Falls Railway and the Rumford Falls & Rangeley Lakes Railroad, and these leases and other interests are covered by the lease of the Portland & Rumford Falls Railroad to the Maine Central. The Portland & Rumford Falls Railway owns a line from Rumford Junction, Me., on the Maine Central, to Rumford Falls, 54 miles, and also a 10-mile branch to Otis Falls. The Rumford Falls & Rangeley Lakes runs from Rumford Falls north to Oquossoc, 36 miles. The Portland & Rumford Falls Railroad was recently incorporated to build from Poland, on the P. & R. F. Railway, south to the coast at Portland and Falmouth. The stockholders of the Maine Central have also ratified the purchase of the Somerset Railway, which runs from Oakland, on the Maine Central, to Bingham, 42 miles. (April 12, p. 532.)

Merchants' & Miners' Transportation Company.—The stockholders have authorized an issue of $3,250,000 4 per cent. 25-year debenture bonds and an increase of $3,000,000 in capital stock. The bonds are to be given to the New York, New Haven & Hartford to pay for the Boston & Philadelphia Steamship Co., and $2,500,000 of the new stock will be paid to the New England Navigation Company in exchange for $2,000,000 capital stock of the New York, New Haven & Hartford. The last named securities, together with the remaining $500,000 new Merchants' & Miners' Transportation stock, will be distributed to present shareholders as a stock dividend. (Mar. 29, p. 468.)

New York Central Lines.—Gross earnings for April were as follows:

	1907.	Inc. or dec.
New York Central & Hudson River	$8,039,260	Inc. $1,352,176
Lake Shore & Michigan Southern	3,598,636	" 224,201
Lake Erie & Western	402,123	" 2,700
Chicago, Indiana & Southern	265,887	" 78,681
New York, Chicago & St. Louis	925,155	" 121,199
Michigan Central	2,367,877	" 325,408
Cleve., Cincinnati, Chicago & St. Louis	2,158,884	" 342,359
Peoria & Eastern	223,232	Dec. 3,170
Cincinnati Northern	88,327	Inc. 6,975
Pittsburg & Lake Erie	1,163,836	" 40,716
Rutland	251,189	" 43,493

New York, New Haven & Hartford.—See Merchants' & Miners' Transportation Company.

Portland & Rumford Falls.—See Maine Central.

St. Louis, Iron Mountain & Southern.—Bioren & Co., Philadelphia, are offering at a price to yield 5¼ per cent. $3,660,000 5 per cent. equipment trust notes. They are secured on 4,500 box cars costing $4,065,300, and mature in 10 equal annual instalments, beginning June 1, 1908.

Somerset Railway.—See Maine Central.

United of Havana.—This company proposes to exchange for each $100 common stock of the Havana Central, $35 in United of Havana deferred ordinary stock; and for each $1,000 5 per cent. first mortgage bond of the Havana Central, $1,000 in United of Havana 4 per cent. debentures, and also cash equal to the interest on the 4 per cent. debentures for certain short periods because of the difference between the interest dates of the debentures and the first mortgage bonds. The Havana Central is building 120 miles of road to be operated by electric locomotives. The lines radiate from Havana, and will carry both freight and passengers. The company has outstanding $8,500,000 common stock and $8,162,500 first mortgage bonds.

United Railroads of San Francisco.—See United Railways Investment Company.

United Railways Investment Company.—The directors have voted to buy at par $1,500,000 of the $5,000,000 first mortgage preferred cumulative 6 per cent. stock of the United Railroads of San Francisco, recently authorized. The investment company controls the railroad company. The new issue is for new construction and improvements.

Wisconsin Central.—According to press despatches, the Chicago, Milwaukee & St. Paul has announced that it will not renew the agreement, expiring in 1910, whereby the Wisconsin Central uses the C., M. & St. P. tracks from Rugby Junction into Milwaukee, 28 miles. It is said that the arrangement congests the Milwaukee terminals.